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ART I.—*Further Descriptions of the Tertiary Polyzoa of Victoria.—Part II.*

BY C. M. MAPLESTONE.

(Plates I. and II.)

[Read 9th March, 1899.]

Stenostomaria solida, Waters, sp. (Pl. I., Fig. 1 and 1*a*).

Oœcium subglobose, or galeate, with large, subquadrate, depressed, but convex, coarsely granulated area in front, surrounded with a thick, elevated margin (in the upper part double), which at the centre of the top is disconnected, the ends curving slightly upwards; at the lower angles it extends only a short distance over the oœcial opening and curves upwards with thickened, rounded ends. A zoœcium above the depressed area with the thyrostome rounded above, contracted by a denticle on each side, with an acute deep sinus in the lower margin, a ridge on each side of the thyrostome extending outwards as a continuation of the margin of the depressed area, bearing a small oval avicularium on the summit. Oœcial aperture wide, arched above. Dorsal surface very convex, with a ridge around the margin and a central vertical one running over an oval enlargement in the centre.

Locality.—Mornington. (T. S. Hall). A single specimen which, unfortunately, is imperfect, in that it has not the usual proximal zoœcium, so that the shape of the oœcial aperture is not defined. The thyrostome of the upper zoœcium is not quite perfect, but is sufficiently so to show that its shape is the same as that of the ordinary zoœcia of *S. solida;* and on the dorsal surface is a globose elevation under a median ridge similar to that which exists in some specimens of this species.

As *S. solida* is the only species of the genus known, and it is very plentiful in the deposit in which this was found, I think it is quite certain this oœcium belongs to that species.

Catenicella nutans, n. sp. (Pl. I., Fig. 2).

Oœcium oval, with broad base, round in section. Two large falcate or crescentic, deeply depressed areas (irregularly and coarsely granulated), and a small, crescentic, slightly depressed area on each side below them in front; also a semi-elliptical one on the summit. Oœcial aperture very wide; upper margin arcuate, lower curved but partially hidden by the front surface of the zoœcium which is bent over at about a right angle to the axial line of the oœcium. The zoœcium has three pyriform fenestræ, with elevated edges; the orifice of the connecting tube is exposed to view.

Locality.—Mornington. (Rev. A. W. Cresswell). A single specimen, very perfectly preserved.

Catenicella conica, n. sp. (Pl. I., Fig. 3).

Oœcium semi-oval or conical, very rugose, with a short tube at the summit (probably avicularian); oœcial aperture wide, arched above, sinuous below; an elongated, curved umbo on each side of it; the surface of the upper portion is very uneven, rugose, with several small depressed areas of irregular shape. The proximal zoœcium very broad, front indistinct, being turned upwards, but there are traces of 2·3 fenestræ; the lateral processes are very wide, extending beyond the oœcium, and have two hollows or depressions on each side.

Locality.—Muddy Creek. (T. S. Hall).

This, like *C. nutans*, bends over the proximal zoœcium so that the latter shows in perspective, and the whole of the orifice of the connecting tube is exposed to view. It is not very well preserved, but the shape of the oœcium and the very broad proximal zoœcium distinguish it from any other species. A single specimen only seen.

Catenicella rotundata, n. sp. (Pl. I., Fig. 4).

Oœcium globose, with a large, very deep crescentic depression, the surface of which is very coarsely granulated on each side, and a depression at the summit. Oœcial aperture very wide, arcuate above, nearly straight below. Proximal zoœcium subquadrate, with four fenestræ.

Locality.—Mornington. (T. S. Hall).

A single specimen. This like *C. nutans* and *C. conica* has the proximal zoœcium inclined to the axial line, but not to so great an extent as in those species. The globular shape and the very deep crescentic depressions are characteristic.

Catenicella personata, n. sp. (Pl. I., Fig. 5).

Oœcium irregular in shape, somewhat globose; aperture very wide, oblong, with rounded sides; margin very wide, thick and partially overhanging in front; upper part very rugose, with irregular perforations over the middle portion. Proximal zoœcium subtriangular with five fenestræ.

Locality.—Mornington. (T. S. Hall).

A single specimen. It is possibly imperfect, but is quite distinct from any other species. It, like the three previously described species, has the oœcium inclined to the zoœcium, and the slide had to be tilted to gain a view of the fenestræ.

Among the *Catenicellæ* described and figured by Dr. MacGillivray in his Monograph, are *C. circumcincta* (Waters), *C. expansa* (McG.), *C. tenuis* (McG.), *C. mamillata* (McG.), and *C. pulchella* (mihi), which, with four new species described in this paper, form a distinct group characterised by the fenestræ being round or oval, distinctly separated; not pyriform and aggregated as in the other *Catenicellæ*.[1] All are found fossil in our Tertiary deposits, the only one which has also been found living is *C. pulchella* which was described by me in the Journal of the Microscopical Society of Victoria in May, 1880. It was afterwards described by Dr. MacGillivray to this Society in November, 1880, as *C. concinna*, which he then stated might be my *C. pulchella*, but that I had described the ornamentation as "round bosses." Afterwards he recognised my species, and Busk in the "Challenger" Reports, describes it on page 13, and figures it (Pl. I., Fig. 4) showing the so-called fenestræ as bosses, as I had described them; and he says, "at first sight *scarcely referable to either the fenestrate or vittate section.* But it appears properly to belong to the latter," for which section Dr. MacGillivray

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1 In speaking of *Catenicellæ* I allude to the genus as defined by Dr. MacGillivray, not the *Catenicellæ* of Busk.

instituted the genus *Caloporella*. I quote this because I think that probably the whole of this group, when living, had bosses, or elevations on the front, and not, as shown in the fossils, perforations only; and also as a warrant for making a new genus to include the species of this group, which is a well-defined one.

In this connection I would wish to state that the recent species of *Catenicellidæ* which I, when at Portland, found and examined alive showed that the fenestræ were, in most cases, elevations not depressions or cavities, the ectocyst where covering the fenestræ being distended and raised. I have noted in my diary the following species in which the fenestræ showed as elevations, *C. lorica*, *C. margaretacea*, *C. alata*, *C. carinata*, *C. perforata* and *C. hastata*.

Strongylopora, nov. gen.

Zoœcia ovoid, a submarginal row of round or oval pores, segregated, not aggregated.

The following are the species which I assign to this genus :—

Strongylopora pulchella (Map.)

Catenicella pulchella, Map. J.M.S. Vic., May, 1880.
C. concinna, McG. T.R.S.V., Nov., 1880.
C. pulchella, McG. P.Z.V., 1889.
C. pulchella, McG. Monograph p. 11.
C. pulchella, McG. Busk, "Challenger," xxx., p. 13.

Strongylopora circumcincta (Waters, sp).

Cat. circumcincta, Waters. Q.J.G.S., 1883, p. 432.
Cat. circumcincta, McG. Monograph, p. 9.

Strongylopora expansa (McG. sp.)

Cat. expansa, McG. Monograph, p. 10.

Strongylopora mamillata (McG. sp.)

Cat. mamillata, McG. Monograph, p. 10.

Strongylopora tenuis (McG., sp.)

Cat. tenuis, McG. Monograph, p. 10.

Strongylopora complanata, n. sp. (Pl. I., Fig. 6.)

Zoœcium broad, ovate, flat, with very wide, smooth, lateral processes, extending upwards as broad, flat, rostra; avicularium

on one side large, curved; on the other aborted. Fenestræ 13 round submarginal. Thyrostome arched above; lower lip with a wide sinus, in each angle of which is a small round papilla.

Locality.—Muddy Creek. (T. S. Hall). A single specimen.

This is allied to *S. pulchella*, but the lateral processes are much wider than even in recent specimens of that species; the papillæ at the angles of the sinus in the lower lip of the thyrostome are peculiar and the whole zoœcium is very flat, the only indication of the shape of the zoœcial cell being the row of pores.

Strongylopora nitida, n. sp. (Pl. I., Fig. 7).

Zoœcium oval, front slightly convex; fourteen oval submarginal fenestræ. Thyrostome arched above, lower lip with a wide, quadrate sinus in the centre. Lateral processes with smooth supra-avicularian processes extending upwards as acute rostra. Avicularia small, on a level with the thyrostome.

Locality.—Muddy Creek. (T. S. Hall). A single specimen.

This is allied to *S. complanata* but is distinguished by the convexity of the zoœcium, the broad quadrate sinus in the lower lip and the acuminate supra-avicularian processes.

Strongylopora ampullacea, n. sp. (Pl. I., Fig. 8).

Zoœcium oval, vasiform dorsally; lateral processes very wide, smooth; a small avicularium at each upper angle; fenestræ fourteen round perforations. Thyrostome suborbicular.

Locality.—Clifton Bank, Muddy Creek. (T. S. Hall). A single specimen.

It is allied to *S. expansa*, *S. pulchella*, *S. complanata*, and *S. nitida*, but it has not the suboral pore of the first-named, nor sinus in the lower lip of the other species.

Strongylopora cuneiformis, n. sp. (Pl. I., Fig. 9).

Zoœcia elongated, cuneiform; thyrostome arched above, nearly straight below, with a small denticle on each side, near the lower angles; lateral processes only visible in upper portion, where they are wide, retrocedent, with small avicularia at outer angles and long, pointed rostra directed upwards and somewhat dorsally.

Locality.—Mornington. (T. S. Hall).

This is allied to *S. tenuis*, but the lateral processes are very much more produced upwards into long retrocedent rostra which arise from the dorsal surface of the lateral processes.

The species of the preceding genus are characterised by having segregated, round, fenestræ as distinguished from the aggregated, pyriform fenestræ of *Catenicellæ*. I have found a form, which possesses both kinds, for which it is necessary to establish a new genus, and on examination of my slides of recent polyzoa to compare with the fossils I discovered I have another species which will be described in a separate paper.

Digenopora, n. gen.

Zoœcia with two sets of pores or fenestræ, one set submarginal, segregated, oval or round; the other set, on the front of the zoœcia below the thyrostome, pyriform.

Digenopora compta, n. sp. (Pl. I., Figs. 10 and 10*a*).

Characters as for genus. Zoœcia ovate and ventricose, 7·9 pyriform fenestræ on the front; 9·13 oval or round perforations outside the inner group. Large sessile avicularia at upper angles of the Zoœcia.

Localities.—Bairnsdale (J. Dennant); Mornington and Muddy Creek (T. S. Hall).

The geminate pair is from the Mitchell River near Bairnsdale, the single zoœcium is from Mornington and I have another single zoœcium, which, though slightly smaller, I consider belongs to this species, from Muddy Creek, I had at first supposed each of them to be of different species, seeing they came from places so wide apart, but there is not sufficient difference between them to warrant their separation. It will be seen that the zoœcia of the geminate pair are not exactly the same as the single zoœcium, but there is not more difference than often occurs between geminate and single zoœcia of other species.

The specimens of recent *Catenicella cribraria* in my cabinet show, I think, that that species probably should be relegated to this genus, as the marginal fenestræ are circular and decidedly larger than those on the middle of the zoœcia, but the latter are

scattered irregularly over the surface, not confined in a scutiform area. Dr. MacGillivray's figure of this species in his Monograph (Pl. I., Fig. 20) shows the inner finestræ more regularly disposed than they are in the recent species, so much so that I think it very probable it is not *C. cribraria*, but, a new species of Digenopora very closely allied to D. compta.

Catenicella halli, n. sp. (Pl. I., Figs. 11 and 11*a*).

Zoœcia ovoid. Fenestræ 9·11, pyriform, perforated. Thyrostome arched above, slightly curved below. Lateral processes broad, convex, with infra-avicularian and pedal chambers. Avicularia upon a broad protruding base. Supra-avicularian processes extending upwards into a long, curved, spinous process.

Locality.—Moorabool. (T. S. Hall).

Allied to *C. cincta* but is very much larger and has peculiar protruding bases for the avicularia. In the geminate pair the pedal chamber on one side is broken away and in the upper part the lateral processes are wider and more protruding than in the single zoœcia.

Catenicella acuminata, n. sp. (Pl. I., Fig. 12).

Zoœcia ovate. Fenestræ 11, pyriform, perforated. Thyrostome arched above, nearly straight below. Lateral processes wide, with large infra-avicularian and pedal chambers, the surfaces of which on one side are convex; avicularia small, on a level with the thyrostome; super-avicularian processes with hollow chambers, or perforations above the thyrostome; outer angle continued upwards into a very long spine.

Locality.—Bairnsdale. (J. Dennant). A single specimen, allied to *C. halli* but much larger, the superstructure above the thyrostome is different and it wants the protruding base to the avicularia.

Catenicella papillata, n. sp. (Pl. II., Fig. 14, 14*a*, 14*b*).

Zoœcia elongate, front surface smooth. Fenestræ 7. Lateral processes broad, smooth, with very slightly depressed infra-avicularian areas. Geminate zoœcia with 9·11 fenestræ. Thyrostome arched above, hollow below. Dorsal surface covered with small, round, papillæ.

Locality.—Clifton Bank, Muddy Creek. (T. S. Hall).

The characteristics of this species are the very smooth front and papillose dorsal surfaces. The geminate pair is on the front view somewhat different from the single zoœcia, notably in having a greater number of fenestræ (an unusual occurrence) but the dorsal surface showed that it belonged to the same species. I would wish to note that the dorsal surface figured is that of the single zoœcium (Fig. 14*a*) which was drawn before it was mounted. I afterwards found another and mounted it on the same slide to show the dorsal surface, but it is imperfect, so I have reproduced the drawing of the perfect one.

Catenicella baccata, n. sp. (Pl. II., Figs. 15 and 15*a*).

Zoœcia elongate. Lateral processes with depressed pedal and infra-avicularian areas. Fenestræ 15·17, oval, depressed; not perforated. Thyrostome arched above, slightly hollow below; peristome raised, produced upwards as a ridge, and laterally as thickened ridges, at the extremities of which are small avicularia. Dorsal surface coarsely papillose with a small sulcate area.

Locality.—Mornington. (T. S. Hall). A single geminate pair.

This is allied to *C. papillata*, but is distinguished by being much larger, more elongate, the papillæ on the dorsal surface are larger and oval, the front surface is not so smooth and it has lateral ridges with avicularia at the outer ends. The fenestræ are also peculiar, being oval depressions not perforations.

Catenicella ampliata, n. sp. (Pl. II., Figs. 16 and 16*a*).

Zoœcia broadly ovate, rather flat in front. Fenestræ 11, elongated, pyriform, convex and perforated. Thyrostome lofty, arched above; sinuous below. Lateral processes very wide and flat, with a very narrow pedal depression. Avicularia at upper angles with large conical flat rostra above. Dorsal surface very much raised longitudinally so that a transverse section of zoœcium proper is triangular with rounded corners.

Locality.—Mornington. (T. S. Hall).

The specimen drawn has the conical rostra perfect, but as the thyrostome is imperfect I have drawn one (Fig. 16*a*) with the fenestræ from another specimen on the same slide.

Catenicella dennanti, n. sp. (Pl. II., Fig. 17).

Zoœcia quadrate, ventricose. Fenestræ 9·11, large, pyriform, with raised margins. Thyrostome lofty, arched above, nearly straight below. Lateral processes small. Large prominent, auricular, avicularia at upper angles.

Locality.—Bairnsdale. (J. Dennant). A single geminate pair.

Catenicella hiulca, n. sp. (Pl. II., Fig. 18).

Zoœcium ovoid, flat in front. Fenestræ indistinct, probably 7. Thyrostome arched above, sinuous below, prominent. Lateral processes very wide, projecting forwards with a very large imperfectly developed avicularium on each side.

Locality.—Muddy Creek. (T. S. Hall),

The large imperfect avicularia and the lateral processes projecting forward are distinctive. In the figure the right hand lateral process is seen edgeways.

Catenicella acutirostris, n. sp. (Pl. II., Fig. 19).

Zoœcia ovate. Fenestræ 7. Lateral processes with deeply depressed infra-avicularian and pedal chambers. Thyrostome lofty, arched above, incurved below. Avicularia at upper angles, with very long mandibles and a semi-circular cavity at the lower part, separated from the mandibular cell by a bar.

Locality.—Muddy Creek. (T. S. Hall).

This is a solitary specimen and though imperfect it is evidently quite distinct from any described species as the avicularia are peculiar in having a long, almost acicular mandible and a semi-circular cavity, with a perforation at the bottom, separated from the mandibular cell by a bar, or plate; the avicularium on the right hand side (in the figure) is broken away but a portion of the bar, or plate, is preserved.

Costaticella, nov. gen.

Zoœcia ovoid, rather flat. Front surface with very numerous narrow, elongated ribs diverging from a median line.

This genus I institute to include the new species described below and *Catenicella lineata*, of which Dr. MacGillivray remarks that it is "a very peculiar species, totally unlike any other."

Costaticella lineata, McG.

Catenicella lineata, McG. Monograph, p. 14, pl. i., fig. 30.

Costaticella escharoides, n. sp. (Pl. I., Fig. 13).

Zoœcia elongated, oval, flat; lateral processes wide, with supra- and infra- avicularian and pedal chambers. The central area is flat and composed of many (22 or more) narrrow, convex ribs, imperforate, but small fissures are present which may be the result of attrition; the median line, on which the ribs abut, is zigzag.

Locality.—Mornington. (T. S. Hall).

This is allied to *C. lineata* but the fenestral ribs are not perforated at the ends as in that species, and the lateral processes are very wide; unfortunately they are imperfect, the outer portions being broken.

Strophipora excavata, n. sp. (Pl. II., Fig. 20 and 20*a*).

Zoœcia small, somewhat quadrate. Thyrostome suborbicular; a raised band extending from the base of the zoœcium to the thyrostome, with a median oval depression in the upper part; depressed areas on each side with 2·3 pores. Avicularia at upper angles. Dorsal surface with much depressed areas on each side of the zoœcia.

Locality.—Clifton Bank, Muddy Creek. (T. S. Hall).

This differs from *S. harveyi* in its smaller size and the deep wide depression on the dorsal surface leaving a *broad* raised median portion at the rear of each zoœcium and not a narrow linear ridge.

Strophipora sulcata, n. sp. (Pl. II., Figs. 21 and 21*a*).

Zoœcia ovoid, front with a raised broad band in the centre, with a depressed area on each side in which are 2·3 perforations. Thyrostome arched above, imperfect below, wide lateral processes above the thyrostome with avicularia at outer angles. Dorsal surface smooth, with a narrow, deep furrow on each side.

Locality.—Clifton Bank, Muddy Creek. (T. S. Hall). A single specimen.

The thyrostome is imperfect but the deep narrow furrows on the dorsal surface are very distinctive and separate it from the last described species.

Catenaria tenuis, n. sp. (Pl. II., Fig. 22).

Zoœcium tubular below, ventricose and ovate above. Thyrostome suborbicular. Front of zoœcium oval, raised; upper part divided radially into four triangular areas; two lateral and two distal; the lower part with a narrow, irregularly curved, raised band or fillet. An avicularium on a broad, blunt, retrocedent rostrum at each upper angle. Socket for connecting tube, or base, of distal zoœcium on the side.

Locality.—Muddy Creek. (T. S. Hall). A single specimen.

It is much smaller but is very similar in form to *C. bicornis*, Busk (Challenger Polyzoa, p. 14, pl. iii., fig. 2). The ornamentation of the surface of the raised oval area is not very well preserved and rather difficult to make out, but it is quite different from that of *C. bicornis*. The genus has not been hitherto recorded as fossil.

Catenariopsis, nov. gen.

Zoœcia pyriform, ventricose. Thyrostome suborbicular; below which is a semi-circular opening at the upper part of which is a flat descending plate, with a curved slender process at each end, pointing downwards into the cavity of the zoœcia and towards the sides; below this is a crescentic area, finely punctate. A perforation (avicularian?) on each side above the thyrostome. Zoœcia tapering downwards into a peduncle.

Catenariopsis morningtoniensis, n. sp. (Pl. II., Fig. 23).

Characters as for genus.

Locality.—Mornington. (T. S. Hall).

This a most puzzling specimen. It is very like a *Catenaria* in form (hence the name) but the two openings are very peculiar. I have described the upper one as the thyrostome as the lower one may be the analogue of the structure of that part of the zoœcia immediately below the thyrostome in *Steganoporella* and *Thalamoporella*, as the spinous process, on one side, seems to

show that they are the folds of a dividing structure seen edgeways. On the other hand this may be the true thyrostome and the upper opening an oœcium with the front broken away, but the appearance hardly seems to warrant this. I have seen only the specimen figured, it is a very strange form. I cannot refer it to any known genus, and there is nothing to show the character of the zoarial growth, though it seems probable it may originate from a creeping stolon like *Ætea* or *Liriozoa.* It is undoubtedly a polyzoon.

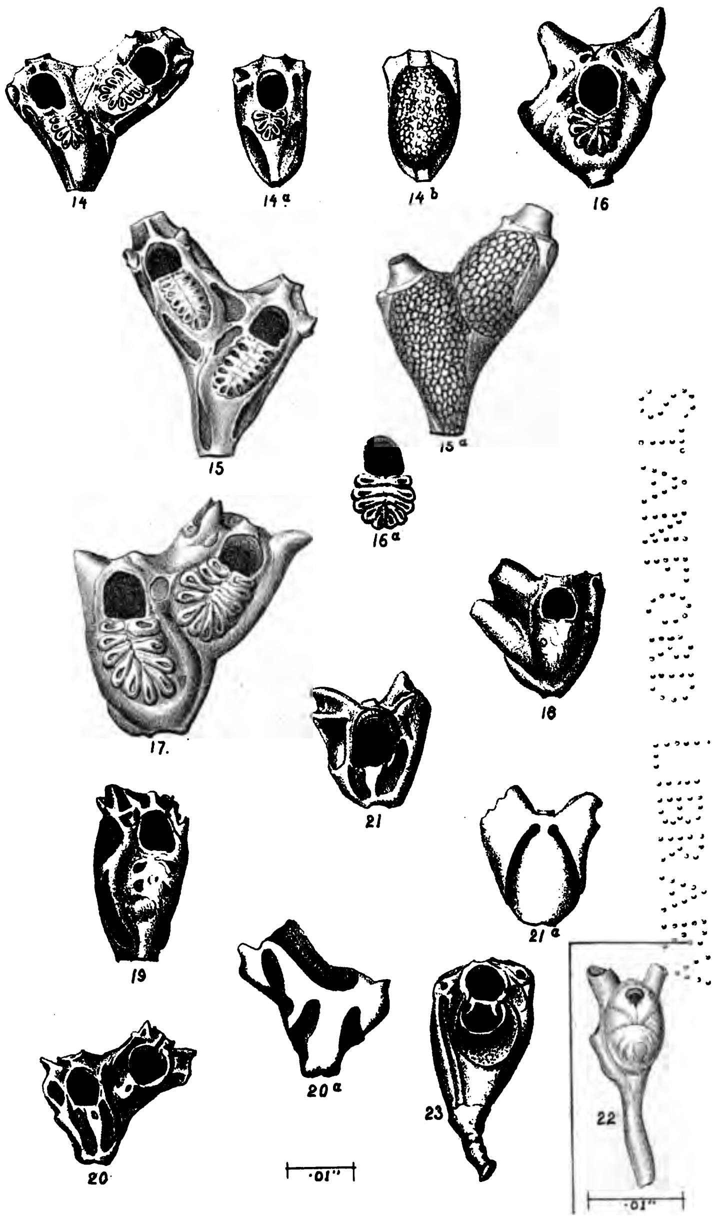
For the information of those who may at any time examine the slides of new species of *Catenicellidæ* described in these papers (all of which will be deposited in the National Museum) I would wish to point out that a few of the first slides I mounted were what I may term "omnibus" slides, *i.e.*, they contained specimens of several species, and as the *Catenicellidæ* are so minute and so fragile (I have found several have developed cracks since they were mounted) that I could not attempt to remount them separately, I have allowed them to remain, but have removed all those which are not new to save observers the trouble of hunting among numerous specimens for the types, except a few to remove which would have endangered them.

EXPLANATION OF FIGURES.

Plates I. and II.

Fig. 1. Stenostomaria solida (oœcium).
„ 2. Catenicella nutans.
„ 3. C. conica.
„ 4. C. rotundata.
„ 5. C. personata.
„ 6. Strongylopora complanata.
„ 7. S. nitida.
„ 8. S. ampullacea.
„ 9. S. cuneiformis.
„ 10. Digenopora compta.
„ 10*a*. „ „ (single zoœcium).
„ 11. Catenicella halli.
„ 11*a*. „ „ (geminate pair).

R. Wendel lith.



R. Wendel lith.

Fig. 12. C. acuminata.
,, 13. Costaticella escharoides.
,, 14. Catenicella papillata.
,, 14*a*. ,, ,, (single zoœcium).
,, 14*b*. ,, ,, (dorsal surface).
,, 15. C. baccata
,, 15*a*. ,, (dorsal surface).
,, 16. C. ampliata.
,, 16*a*. ,, (Thyrostome and fenestræ).
,, 17. C. dennanti.
,, 18. C. hiulca.
,, 19. C. acutirostris.
,, 20. Strophipora excavata.
,, 20*a*. ,, ,, (dorsal surface).
,, 21. S. sulcata.
,, 21*a*. ,, ,, (dorsal suaface).
,, 22. Catenaria tenuis.
,, 23. Catenariopsis morningtoniensis.

Art. II.—*The Spectra of Oxygen, Sulphur and Selenium, and their Atomic Weights.*

By L. RUMMEL.

[Read 9th March, 1899.]

The researches of Messrs. Runge and Paschen (Wiedemann's Annalen der Physik und Chemie für 1897, 8th Heft, pp. 641 and following) have revealed the existence of novel sets of spectra of great regularity, free from bands and differing, save for a few prominent lines, from the spectra of the same elements as observed by Pluecker, Hittorf and Huggins. The new spectra were obtained, when pure Oxygen or the acids of Sulphur and Selenium were heated in Geissler tubes to a temperature approaching 500°C. over a Bunsen burner while under the influence of an induction current and an air pump. Under these conditions the capillary part of the tube resolved itself into a pure line spectrum, while the wider parts showed a mixture of lines and faint bands. The line spectra of the three metalloids were arranged in triplets, forming two secondary series with indications of a primary series. With Selenium each triplet line seems to be sub-divided into two or more finer lines. The spectrum of Oxygen differed from those of Sulphur and Selenium by showing two additional secondary series of very close doublets with rudimentary members of a primary series.

Among the elements whose spectra have been arranged into distinct series Helium is the only one, which, like Oxygen, yields *two* separate sets of spectral series; and it may therefore be presumed that in both cases similar causes are bringing about the same results. Helium being regarded as a compound, consisting of Helium proper and Parhelium, which slightly differ in density, although no complete separation has yet been effected, it follows in reason that Oxygen must likewise be a compound.

To show that this conception does not clash with the investigations of the chemist, I beg to quote Debus (Liebig's Annalen der Chemie, 1888, Band 244, p. 144) who, after treating exhaustively

on Ozone and its properties, says expressly: "The molecules of oxygen are by electricity broken up into atoms, which in statu nascendi unite with other oxygen molecules, forming ozone. The ozone molecules, by colliding with each other, are retransformed into oxygen molecules."

It would seem that, as the operations of Runge and Paschen were conducted at a temperature greatly exceeding the point above which ozone is able to exist (290°C.), a separation of the constituents of Oxygen takes place under the influence of heat and electricity.

From a consideration of the difference of the vibration numbers of the triplet and doublet lines, as given more fully later on, the atomic weight of the triplet constituent is 12, and of the doublet constituent 4. The former I propose to call Alphaoxygen, the latter Betaoxygen.

From a comparative table, furnished by the authors, it appears that six of the triplets of Alphaoxygen and five doublets of Betaoxygen coincide almost exactly with atmospheric lines. One triplet and two single lines, the latter of Betaoxygen, have also been observed among the bright lines of the sun's chromosphere. It would therefore appear that both gases are present in a free state either in the sun or in the earth's atmosphere, for the dark lines of the sun's spectrum, caused by Oxygen, would, after passing through a variable layer of terrestrial oxygen, be simply intensified, while the bright lines of the chromosphere would be correspondingly weakened. The preponderance of the dark over the bright lines observed would thus be accounted for. The presence of Alpha- and of Beta-oxygen in the sun may therefore be considered as fairly established.

The computation of the constants according to the formula, $\lambda_n = x + \dfrac{y}{n^2 - z}$ has been effected by means of the equations, published by the Royal Society of Victoria in their Proceedings for 1897, Vol. X. The equation of n may be simplified. If a, b, c, d, are the respective wave lengths of a sequence of four lines and $\alpha = \dfrac{(a-d)(b-c)}{(a-c)(b-d)}$, then $n = -1{\cdot}5 + \sqrt{\dfrac{\alpha}{4\alpha - 3}}$.

I may also call attention here to a few misprints occurring in the same paper. In the Table of Constants under x in the third

column on the fifth line read 3421·05 instead of 2421·05, and on the last line 4081·66 instead of 4085·66.

While the computed and experimental values as a rule agree very closely, there are a few series, like the one of Betaoxygen, that cannot be brought into exact accordance. The reason of this peculiarity has yet to be accounted for.

The computation of the Constants in this paper has been done in the following manner. From the first four lines of each particular series I ascertained the value of root x. Comparing then the values of the normal series with the corresponding one of the abnormal series I selected the two that were in best accord. For Oxygen and Sulphur these happened to be the middle lines, for Selenium the least refrangible line. The difference of those two roots I found to be for Oxygen, ·0595, for Sulphur, 1·198, for Selenium, 1·063. Taking the mean of the two values for my corrected root, I determined the remaining three Constants from the first three lines. I then computed the wave numbers of the remaining lines of the series. Then, converting these wave numbers into their corresponding vibration numbers, I added or subtracted, as required, the mean difference of the vibration numbers of the triplets. This difference amounts to 3·70 and 2·08 in Oxygen, to 18·15 and 11·13 in Sulphur, and to 103·68 and 44·63 in Selenium. Having thus found the vibration numbers of the remaining series, I reconverted them into wave numbers and ascertained their Constants. The reader will find them in the accompanying Tables.

Of the doublet or Betaoxygen series Runge and Paschen have given the measurement of only one pair, viz., 6046·564 and 6046·336. Their respective vibration numbers are 16538·24 and 16538·94 or a difference of ·70. The mean root of the two subordinate series having been found equal to 4712·657 in wave numbers, their respective separate roots will be 4712·727 and 4712·587 with a difference of ·14.

Turning to the Table of Constants we find the difference of the roots of the first and third line of the triplets : Alphaoxygen = 1·072 ; Sulphur = 7·243; Selenium = 39·73. Taking the square roots of these numbers, we obtain Alphaoxygen = 1·04 ; Betaoxygen = ·37 ; Sulphur = 2·69 ; Selenium = 6·30.

$n+$
1
1
1
2
2
2
3
3
3
4
4
4
5
5
5
6
6
6
7
7
7
8
8
8

The atomic weights of elementary bodies being directly proportionate to these numbers, as I have shown in regard to the Alkalies and Helium, and have also found to be true for other metals, we obtain the following atomic weights, when taking Sulphur = 32; viz., Alphaoxygen = 12·37; Betaoxygen = 4·40; Selenium = 74·91; or in round numbers: Alphaoxygen = 12; Betaoxygen = 4; Sulphur = 32; Selenium = 75.

The last number falls short by four of the atomic weight, found for that metalloid by chemists, but would seem to fit much better into the map of elements as arranged by Mendelejeff. Possibly Betaoxygen may enter into its constitution and thus complete its full atomic weight.

The principal series have been found to be represented by the head line and second line in Alphaoxygen, and by the second and third lines of Betaoxygen. Sulphur and Selenium have each only one line. Of the two last mentioned my formula can take no account; of the two first I have computed the probable Constants and a few additional members by availing myself of Rydberg's now well known law and assuming the most likely value for the modulus n. My results somewhat differ from the values computed by Runge and Paschen. Further, and, I hope not distant, observations may throw more light on the subject.

TABLE OF WAVE LENGTHS II.

SELENIUM.

n+	*b*	R. & P.	*c*	R. & P.
1	13932·40		25402·22	
1	13734·03		24750·39	
1	13650·34		24479·97	
2	8106·54		9083·42	
2	8038·97		8998·68	
2	8010·23		8962·68	
3	6746·65	6746·65	7062·14	7062·14
3	6699·78	6699·78	7010·81	7010·84
3	6679·66	6679·72	6988·94	6990·96
4	6177·87	6177·87	6325·40	6325·40
4	6138·55	6138·51	6284·18	6284·19
4	6121·78	6121·95	6266·61	6266·36
5	5878·88	5878·88	5961·70	5961·70
5	5841·92	5843·10	5925·07	5925·13
5	5828·06	5827·90	5909·45	5909·49
6	5700·35	5700·32	5752·28	5752·31
6	5666·86	5666·95	5718·18	5718·28
6	5652·56	5652·62	5703·62	5703·86
7			5619·63	5618·05
7			5587·09	
7			5573·18	
8			5529·92	5528·64
8			5498·39	5497·06
8			5485·06	
9			5466·24	5464·82
9			5435·44	
9			5422·29	

TABLE OF CONSTANTS.

Element.	n	z	x	y
Alpha Oxygen				
a_1	1·0 ?	2·46389	2771·651	7687·17
a_2	1·0 ?	2·46339	*Id.*	7687·12
a_3	1·0 ?	2·46288	*Id.*	7686·54
b_1	1·9639	4·6772	4307·870	20421·13
b_2	*Id.*	4·67623	4307·184	20414·99
b_3	*Id.*	4·6760	4306·798	20410·97
c_1	1·8036	4·93164	4307·870	20486·8
c_2	*Id.*	4·93097	4307·184	20480·1
c_3	*Id.*	4·93051	4306·798	20476·5
Beta Oxygen				
a	1·94 ?	2·35354	3074·665	8138·08
b	2·000	5·25504	4712·657	24604·06
c	1·89665	5·4722	*Id.*	24683·80
Sulphur				
b_1	1·9755	5·7495	4977·370	27338·74
b_2	*Id.*	5·7406	4972·877	27294·95
b_3	*Id.*	5·7379	4970·127	27264·43
c_1	1·4904	4·9247	4977·370	27123·9
c_2	*Id.*	4·9210	4972·877	27073·8
c_3	*Id.*	4·9184	4970·127	27043·2
Selenium				
b_1	1·677	3·99139	5195·50	27739·13
b_2	1·677	3·96261	5167·66	27442·90
b_3	*Id.*	3·94562	5155·77	27321·38
c_1	1·434	4·52640	5195·50	28249·81
c_2	*Id.*	4·49753	5167·66	27947·50
c_3	*Id.*	4·48479	5155·77	27819·40

Art. III.—*A New Rotifer Lacinularia striolata, with Note on L. pedunculata.*

By J. SHEPHARD.

(With Plates III., IV., V.)

[Read 13th April, 1899.]

The rotifer forming the subject of the first part of this paper has been well known in Victoria for a number of years, but has always been regarded by me as *L. pedunculata* mentioned by Dr. Hudson in the supplement to "The Rotifera" (p. 7). No figure accompanies the very brief description there given. Meeting with this form in very large numbers in a shallow pond near the Glen Eira Road, Caulfield, I was led to study it with a view to place on record some figures and further information with regard to it. While engaged in this work another similar form appeared in a cultivation from dried mud gathered at Cheltenham, but differing from the first and better known rotifer in several particulars.

Visiting Mr. Thos. Whitelegge, of the Australian Museum, Sydney, I mentioned the work I was engaged on, and he very kindly lent me his drawings of the rotifer he sent to Dr. Hudson, who named it from the spirit specimens *Lacinularia pedunculata*. From a comparison of these sketches with my own drawings and specimens I have arrived at the conclusion that the form first seen by Mr. Whitelegge, and referred to by him in the short descriptive paragraph quoted by Dr. Hudson, was certainly not the better known form, but more probably identical with the one from Cheltenham.

Lacinularia striolata, n. sp.

The animals are found in clusters varying in size from 5 mm. diameter to mere points barely visible to the naked eye. A peduncle sometimes as much as 10 to 12 mm. long anchors the colony to the stem of a submerged plant. The colour varies

from a yellowish-orange to a greenish tint. As Mr. Whitelegge remarks, "a cluster might easily be mistaken for the fallen flower of an Acacia." Examination under the microscope shows the cluster to consist of individual rotifers occupying and protruding from radial perforations in a gelatinous sphere (Fig. 1); all the feet extending quite to the centre, where they are attached to a round peduncle of deep brown colour, dense looking, somewhat scarred, and expanding at its base. When subjected to any shock the animals retract themselves into the tubes, but soon extend again. The action of the ciliary wreaths of a large colony produces a very distinct current in the water, and this is the more marked from the habit the animals have of so placing themselves that all the individuals over a large portion of the colony are operating to produce a current in the same direction. In a colony of 5 mm. diameter an estimate of the number of rotifers calculated from those counted in a given area of its surface gave the total number for the whole sphere as 3681.

External Characters of Adult Female.—Individuals readily detach themselves from a colony when treated with cocaine, and can be examined in a compressorium without difficulty. Seen in dorsal aspect (Fig. 2) there is a heart shaped corona with a shallow sinus at the ventral edge, and a blunt apex at the dorsal. There is no dorsal gap, and there are two eyes rather more than halfway down placed very close to the edge on either side. The neck is moderately constricted, and the body expands to quite the width of the corona and then tapers away gradually to a long slender foot. A lateral view (Fig. 3) shows the disc of the corona to lie obliquely, its plane being advanced at its ventral edge, and making an angle of about 45° with the long axis of the animal, the ventral outline is rather arched, and the dorsal somewhat hollow but bends outwards about the termination of the stomach, and forms a prominence in which the forward pointing anus is placed. From the anus the body tapers off into the long foot. The whole length is as much as 2·6 mm., and of this only about one-fifth is occupied by the alimentary system, the remaining four-fifths being the foot which is extremely attenuated, one measured near the termination being ·004 mm. across. Two minute antennæ occur rather low down on the neck, wide apart, but on the ventral surface. The whole

of the cuticle is longitudinally striated. These striations were seen in the cut edges of the cuticle in sections to be actual corrugations, and their distance apart I estimated at ·0005 mm.

External Features of Young Female (Fig. 4). These are found swimming freely and are much smaller than the adult, being only ·35 mm. in length. The body is a very gradually tapering cone, widest at the head and ending bluntly. The eyes are more conspicuous than in the adult. At the extremity of the foot there is a ciliated cup (c.c.) in communication with two large glands, of which I shall have to speak later.

Male.—Having a large number of colonies, a little watching soon discovered the male. Numerous specimens were seen hovering around the colonies and occasionally plunging between the closely packed females. They were very active and of small size, only ·17 mm. in length, or $\frac{1}{15}$th of the length of an adult female. In general outline the male (Fig. 4*a*) resembles published figures of *L. socialis.* A ciliated pit (Fig. 4*a*, c.p.) is placed on the ventral surface near the termination of the foot. The conical front has a strong tuft of setæ at its apex seated upon a nerve cell, from which a thread runs backwards to what appears a large nerve mass. The whole of the conical front is ciliated, and there is a ring of strong cilia at the base of the cone which is continued for a short distance ventrally, and is suggestive of a buccal orifice. There are two red eyes, and about $\frac{1}{3}$ of the length of the animal from the front is placed a conspicuous dorsal antenna connected with the nerve mass. Mastax and alimentary system are absent, the latter being represented by a cord running down the centre with a thickened portion about the middle. The sperm sac (Fig. 4, s.s.) is placed near the retractile penis and varies much in size, one specimen having the whole body cavity occupied by it.

Internal Anatomy of Female. Methods.—Mr. Rousselet's valuable method of killing[1] answers admirably with this form, and whole colonies with almost every individual fully extended could be obtained. It was necessary to follow up the first dose of cocaine mixture quickly with stronger doses and narcotize rapidly, as if the process was too prolonged the animals left the

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1 Jour. Queck. Micro. Club, vol. v., ser. 11, p. 5-13, No. 36, March, 1895.

colony. These fixed colonies were amenable to the paraffin method of obtaining serial sections. The stain most successful of those tried was picro-carmine. Considerable care was necessary to pass the specimens through increasing strengths of alcohol and to clear with oil of cloves. A colony thus placed in serial sections of course gave sections through individuals in every possible plane. The results obtained show that a combination of the section method with the older plan of examining the living animal is preferable to following either system exclusively.

Digestive System.—The trochus (Fig. 3, t.) and cingulum (Fig. 3, c.) form separate and complete circuits, and the groove between them is continuous round the disc. The cingulum runs backwards ventrally, forming a triangular space in which is placed the mouth (Fig. 3, m.). The mouth is slit-like, but wider at the anterior, and opens into the buccal cavity (Fig. 5, b.c.). This has a thin roof, and sections parallel with the plane of the disc show a triangular outline widest remote from the mouth, and downwards the walls rapidly converge and form a short funnel terminating in a very narrow pharynx. Nearly the whole of the buccal cavity is thickly covered with cilia. The pharynx (Figs. 5, 6, 7, p.) is close to the ventral surface. At its commencement there are two small openings (Figs. 6 and 7, s.d.) into it, one on either side, which I take to be ducts for the passage of the salivary secretion from two nucleated cells (Figs. 6, 7, 8, s.g.) situated on the floor of the buccal cavity, one on either side of the pharynx. These cells have definite borders, are spongy looking, stain faintly, and do not occupy the whole of the space surrounded by the outer wall, as there appears an unoccupied portion at the base of each. The pharynx is short, and at its lower part becomes a flattened cavity curving round the food cavity of the mastax, extending dorsally a short distance, and ventrally and posteriorly close under the cuticle of the ventral surface, where it terminates about the level of the trophi (see Fig. 5, p. and tr., Fig. 7, p.). This flattened portion communicates with the food cavity by a slit extending along its length (Fig. 7, sl., the T-shaped opening shows the part curved backwards cut across). The cilia on either side shown in Fig. 7 are from the inside of the food cavity, being cut off by the section knife. This slit will serve as a valve to regulate the

entrance of food into the food cavity of the mastax. Sections show the mastax (Fig. 3, ma.) to be of considerable complexity. Seen from the dorsal in the living animal it appears as a tri-lobed mass, the mallei being imbedded in the lateral lobes, and the incus in the posterior. Sections show that the food enters a cavity of heart-shaped section seen ventrally (Figs. 7 and 8, f.c.) and this extends dorsally, becoming crescentic in section more towards the dorsal portion of the mastax (Fig. 10, f.c.). This food cavity, as for convenience I name it, has at the ventral end a membranous floor (Figs. 5, 7, 8, s.m.) which continues dorsally and joins the lateral lobes on their anterior surface. More dorsally it is seen as two membranes joining the roof of the food cavity with the lateral lobes, so that each side forms an inclined plane to direct the food particles between the cutting points of the unci. Below the unci, in that portion of the mastax dorsal of the fulcrum, there is a lower portion of the food cavity (Fig. 10, f.c.). The upper and lower portions of the food cavity are thus separated off when the unci are closed. The food cavity is strongly ciliated at the ventral part on either side of the slit (Figs. 5 and 7, f.c.); above the unci on the roof, and below on the dorsal portion excavated out of the middle of the mastax, are ridges of very thickly packed cilia (Figs. 5, 8, 9, 10, cil.m.). The opening into the œsophagus is close to the dorsal surface of the animal. The food cavity at its ventral part is separated on its sides and floor by the separating membrane (Figs. 5, 7, 8, 9, s.m.) from a cavity, portions of which are shown in Figs. 5, 6, 7, 8 and 9 (m.c.). I was unable to discover any opening into the food cavity or coelom from this mastax cavity. Fig. 10 shows that it does not extend the whole length of the mastax. The separating membrane is exceedingly delicate, and it was by the presence of food particles (Fig. 8, f.p.) always on one side that the food cavity and the mastax cavity were found to be distinct.

It will be noticed that in all the horizontal sections the mastax cavity appears as two separate portions, but I think it very probable that communication is made by means of the portion m.c (Fig. 5) and have therefore treated it as one. The trophi (Fig. 11) when dissolved out with chlorinated soda are seen to be of the malleo-ramate type, characteristic of the genus

Lacinularia and fam. *Melicertidæ.* The finer teeth are at the distal ends of the rami (Fig. 11, r.) and become gradually coarser towards the fulcrum. In a definition of this type[1] we find "unci three-toothed; rami large, with many striæ parallel to the teeth." The appearances noticed both in dissolved out trophi and in sections lead me to conclude that the striæ here spoken of are all teeth, which gradually diminish receding from the fulcrum, or, that the whole of each uncus is a sheet stretching across from the rami to the manubria in which the teeth are formed by parallel thickenings. The fulcrum is imbedded in the mastax at its ventral border (Fig. 9, ful.), so that the finer teeth are near the œsophagus. The action of the whole mastax I take to be as follows:—The food particles are admitted from the pharynx through a valvular slit into the food cavity, which forms in its ventral portion a flexible bag hanging in the mastax cavity, the cilia on either side of the slit propel the matter onwards, then the thick ridge of cilia on the roof comes into action carrying it further and at the same time forces it down between the teeth, while the cilia on the floor of the food cavity act from below in a similar way. The unci as may be seen in the living animal moving with a circular motion inwards and downwards bringing the teeth together and separating them when the motion is reversed. The food matter is thus received by the coarse teeth and passed along to the finer until it reaches the œsophagus. The use of the separating membrane appears difficult to understand, but I suggest that the mastax cavity being filled with fluid exerts a pressure upon the separating membrane and at the same time allows it to distend. This pressure forcing up the sides of the separating membrane would, together with the cilia of the roof, enable the animal to bring the food matter between the teeth. The whole apparatus appears adapted to dispose of the food matter which the trochal disc automatically pours into the buccal cavity. In the first place the pharyngeal end of the mastax may be closed, and the food particles then issue from the posterior of the mouth as is seen in the living animal; then the joint action of the separating membrane and the ciliated ridges keep the food under the

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1 The Rotifera. Hudson and Gosse, vol. i., p. 29.

action of the trophi until it is sufficiently reduced to pass easily into the œsophagus. With regard to the structure of the fleshy portion of the mastax the loops of the manubria each contain a nucleated cell (Fig. 10, nu.m.), as Vallentin found in *M. ringens.*[1] In Fig. 10 there are dotted appearances (fib.) suggestive of fibrous muscles cut across. This, Vallentin was unable to discover in the species he studied.[2] The œsophagus is long and narrow and opens into the upper portion of the stomach (Fig. 5, œ. st.) where the walls are formed of thick nucleated cells. The gastric glands lie on either side of the œsophagus, resting upon the cells of the wall of the stomach, but I was unable to find any ducts connecting them with the stomach. The walls of the stomach are thinner at its posterior portion and it there opens into the intestine (Fig. 5, int.) by a narrow passage. The intestine is thin walled and ends in a rectum directed upwards. The whole of the alimentary tract is ciliated, except the separating membrane of the food cavity of the mastax. That ciliation of the mastax occurs does not appear to have been noticed in other species investigated.[3]

Excretory System.—The lateral canals extend from the rectum to the trochal disc. Four or five pairs of vibratile tags are present. Four tags are well seen in the living animal close under the cuticle of the trochal disc (Fig. 2, v.t.). I was not able to find the "renal commissure" uniting the canals at the anterior, but succeeding in tracing in sections the termination of the canals to a point near the rectum, which they appeared to join. A contractile vacuole was not noticed, and if present must be small. The vibratile tags (Figs. 12 and 13) presented appearances entirely consistent with the views expressed previously by myself.[4] They are long and narrow in the form of a flattened cylinder; the walls are more coarsely striated than in other species, and the cap is deep. Tags were readily found in sections lying on edge, but only one doubtful view of the flat aspect was seen. It is to be expected that the flat aspect will be difficult to find in sections, as when viewed in this way in a

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1 Mag. Nat. Hist., vol. viii., ser. 6, p. 47, fig. 4.
2 Vallentin, Mag. Nat. Hist., vol. viii., ser. 6, p. 43.
3 Cam. Nat. Hist., vol. ii., p. 212.
4 Shephard, Pro. Roy. Soc. Vict., vol. xi., p. 130.

fresh specimen they are difficult to keep in view when the undulating movement ceases. It may be interesting to call attention to a certain degree of analogy existing between the vibratile tags and the tube-bearing cells (solenocytes) in the nephridia of the Polychete worms Nephthys, Glycera, and Goniada.[1] The "solenocytes" in these worms consist of thin walled tubes opening into the lumen of the nephridium and terminated by a solid mass of protoplasm from which a flagellum hangs down the tube. These tubes are in pairs in *Nephthys scolopendroides*, and are supported at the extremities by cells forming a "crook." In *Glycera convolutus* the resemblance is closer, there being no support, and the tube is "flattened from side to side," has "the appearance of being delicately fluted." In the case of the vibratile tags and solenocytes both are bathed in the coelomic fluid, and have no opening into the coelom. The only differences in the case of *Glycera* being the existence of a flagellum in place of an undulating membrane, and the base of the cell being broad instead of narrow.

Secreting Glands.—In addition to the cells opening into the pharynx and the gastric glands mentioned already, there are two large flattened bodies lying on either side of the mastax and close to the surface of the disc. These bodies are conspicuous in the living animal when they appear of a yellowish colour. Seen in section they stain very similarly to the pharyngeal glands (Fig. 6, s.g.), but no duct or communication could be found, and I feel unable to offer a suggestion as to their function. From the lower part of the intestine the whole of the foot is occupied with foot glands, one of which is shown in section (Fig. 5, m.g.). Even where the foot has become greatly attenuated they are present. That some of them secrete mucous which is discharged at the termination of the foot seems certain, but possibly they are also concerned in the formation of the gelatinous matrix of the colony, but this I propose to deal with later. These foot glands stain readily and show a distinct nucleus. In the young female they are very numerous and closely packed (Fig. 4, m.g.), rendering the whole foot almost opaque. In addition there are glands near the termination of

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[1] E. S. Goodrich on the Nephridia of the Polychaete Worms. Q.J.M.S., vol xl., p. 191, vol. xli., pp. 442, 452.

the foot (Fig. 4, s.c.g.) not found in the adult, but these will be dealt with when describing the development of a colony.

Nervous System.—Dorsal to the pharynx is a cluster of cells (Fig. 8, g.) of somewhat reticulated appearance. They coincide in position with the ganglion figured by Vallentin,[1] and although I was unable to detect the threads connecting with the marginal nerve cells of the disc, it seems probable that this represents the brain. In the Asplanchnadæ the brain can be easily seen in a specimen suitably killed and fixed with osmic acid. It there appears as a large mass giving off threads in various directions, and it is situated dorsal to the pharynx, as is the case in numerous other species of rotifers. As *L. striolata* leads a sedentary life, and the chief use of its sensory apparatus is to warn it to retract into its tube, it would appear that a simpler nervous organisation would suffice for it than for free swimming predatory animals like the *Asplanchnadæ*. Sections gave no trace of the eye spots. The ventral antennæ (Fig. 2, ant.) were well shown in sections and exhibited some detail of structure I do not remember to have seen mentioned. The section drawn (Fig. 14) shows a spherical cavity with the tuft of setæ springing from the inside and passing through a small perforation in the cuticle (c.u.): the walls of the cavity rest upon a nerve ganglion (n.g.), and from it runs a thread leading in the direction of the head. I may here state that it is difficult to trace the nerve threads, muscles, and other structures passing up the neck, as the mastax so fills the space that only a narrow ring is left where these organs are so closely packed as to be indistinguishable.

Muscular System.—Eight longitudinal muscles are seen in a transverse section of the foot (Fig. 15, mu.) and extend almost to its termination; they appear to run the whole length of the body and terminate in the trochal disc. No trace of circular muscles could be seen.

Reproductive System.—The yolk gland (Fig. 3, y.g.) is conspicuous in the adult female. Apparently there is only a single germarium situated towards the posterior end of the yolk gland (Fig. 16, v.). Ova pass down the oviduct (Fig. 5, ov.) and are extruded at an early stage and undergo development imbedded in the matrix of the colony. Ordinary and "resting eggs" (Fig.

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1 Anatomy of Certain Rotifers. Mag. Nat. Hist., ser. 6, No. 43, p. 47, pl. v., fig. 12.

17) were found, the latter possessing a hard shell with banded markings. No observations of the method of impregnation were made, but males were seen repeatedly plunging into the colony between the females and disappearing from view. Spermatozoa occur in the sperm sac, coiled up in a flask-shaped capsule (Fig. 18), which is ciliated on one side, and on being forced into the water by compression rapidly disintegrates, and the spermatozoon (Fig. 19) is set free. The length of a spermatozoon is about ·045 mm.

Structure of Peduncle and Matrix of Colony.—A transverse section across the peduncle and along the equator of the colony, shows the peduncle composed of a dense brownish mass, with irregularly shaped cavities in it (Fig. 20). Radiating from it and given off from projecting angles are the walls of tubes (Fig. 20, w.t., and Fig. 20, a.) which contain the individual rotifer. For a short distance these tubes are thin and rigid, and then gradually pass into a soft gelatinous substance. The matrix may be regarded as a ball of mucous perforated with radiating conical pits, hardened towards the centre. Each pit contains a rotifer with its foot attached to the bottom (Fig. 20, ter.), which is a short distance from the peduncle, and this forms a septum perforated in the middle to permit the passage of mucous or cement through it. Fig. 20 shows this where *ter.* is the bottom of the pit and the point where the foot terminates, and *muc.* the mucous thread exuding from it and connecting the animals with the peduncle. Evidently the peduncle is the product of the combined exudations of the whole colony and grows in length as the individuals mature, and this is corroborated by the fact that the younger colonies possess a shorter peduncle. The cavities are due to stresses set up by the rates of deposition differing in certain portions of the colony, the cement being plastic near to each animal. As the mucous or foot glands (Fig. 3, m.g.) extend over four-fifths of the entire length of the animal, the formation of the softer and more bulky part of the matrix towards the periphery may be due to secretion from the surface, as is the case in the Floscules, and even in some free swimming forms as the genus *Copeus.* There are reasons for regarding the whole mass as a joint product and not the adherent tubes of the individuals, as will be seen later.

two large cement glands or receptacles. Male: without mastax and alimentary system; two eyes; dorsal antenna; ciliated cup ventrally near posterior.

Dimensions.—Colony, 5 mm. diameter. Peduncle, 10 to 12 mm. long. Adult female, 2·6 mm. long; corona, ·18 mm. wide. Young female, ·35 mm. long. Male, ·17 mm. long. Resting egg, ·145 mm. x ·097 mm.

Habitat.—Brighton, Caulfield. Lagoons along the valley of the Yarra.

Lacinularia pedunculata.

I have only met with two colonies of this species. These remarks and figures are given so that this species may be definitely identified, and in order to make clear the specific differences between it and the form previously dealt with. As in *L. striolata* there is a spherical colony of rotifers attached to a long slender peduncle. The smaller of the two colonies was evidently more developed as the individuals, twenty-two in number, were larger, and ova were numerous. The females composing the colony were about 1 mm. in length (Figs. 24, 25); the corona heart shaped, and three times the width of the body; the plane of the disc being inclined until nearly parallel to the axis of the body. The dorsal gap is absent. The trochus and cingulum are separated by a wide groove, narrowing at the dorsal portion of the corona. Two obvious ventral antennæ occur, and there are two eyes placed about half-way down the corona and close to the trochus. The mouth has two ridges running forward on either side, which have the power of coming together and thus close the mouth. A yellowish mass above the mastax is very conspicuous. The body for some distance below the neck is ridged transversely and tapers away to a long narrow foot. In general outline it resembles *L. socialis* much more than *L. striolata.* The internal atanomy presents no features obviously differing from the usual type of the genus. There seems to be no doubt as to the distinctness of this form from the one previously described as *L. striolata.* The much greater width of the corona, and the different arrangement of the trochus and cingulum as well as the peculiar contractility of the mouth mark it off distinctly. Mr.

Whitelegge[1] is quoted as describing the corona as "intermediate in shape between *L. socialis* and *Megalatrocha alboflavicans.*" This fairly describes the specimens I have seen, and after examining his sketches, I have no doubt that mine are of the same species as those sent to Dr. Hudson, and alluded to in the description quoted. Owing to the few specimens obtained, drawings of the mastax and observations of the internal structure by the section method could not be attempted. The form would doubtless yield interesting matter should an opportunity occur to examine it further.

Specific characters. Colony spherical, with gelatinous matrix and peduncule. Female with corona three times as wide as body; trochus and cingulum wide apart; mouth with contractile processes running forward. Two obvious ventral antennæ. Two eyes.

Dimensions.—Length of female, 1 mm. Width of body, ·08 mm. Width of corona, ·24 mm.

Habitat.—Sydney (Mr. Whitelegge). Cultivation from dried mud collected at Cheltenham.

In concluding this paper, I have to thank Professor Spencer, for advice and willing help in procuring books of reference for me.

LIST OF REFERENCE LETTERS.

s.s.—Sperm sac.
c.p.—Ciliated pit.
c.c.—Ciliated cup.
m.—Mouth.
b.c.—Buccal cavity.
p.—Pharynx.
s.d.—Salivary duct.
s.g.—Salivary gland.
f.c.—Food cavity.
sl.—Slit communicating between pharynx and food cavity.
ma.—Mastax.
m.c.—Mastax cavity.
c.—Cingulum = Secondary ciliary wreath.
cil.m.—Cilia of mastax.
s.m.—Separating membrane.
n.t.—Nerve thread.
n.g.—Nerve ganglion.
mu.—Muscle.
y.g.—Yolk gland.
v.—Vitellarium.
o.—Ova.
ov.—Oviduct.
f.—Foot.
ca.—Cavities.
h.m.—Hardened mucous.

[1] The Rotifera, Hudson and Gosse, Supplement, p. 7.

f.p.—Food particles.
nu.m.—Nuclei of mastax.
fib.—Muscle fibres cut across.
œ.—Œsophagus.
st.—Stomach.
int.—Intestine.
v.t.—Vibratile tags.
m.g.—Mucous gland.
s.c.g.—Special cement gland.
g.—Ganglion or brain.
ant.—Antenna.
t.—Trochus = Principal ciliary wreath.
muc.—Mucous.
ter.—Termination of foot.
c.t.—Cut edge of tube.
w.t.—Wall of tube.
c.g.—Cement granules.
man.—Manubrium.
ful.—Fulcrum.
l.c.—Lateral canal.
cu.—Cuticle.
nu.—Nucleus.
tr.—Trophi.

EXPLANATION OF FIGURES ON PLATES III., IV., AND V.

L. striolata.

Fig. 1. Adult colony. × 7.

„ 2. Adult female. Dorsal aspect. Drawn from living and preserved specimens. × 66.

„ 3. Adult female. Lateral view. From living animals. × 133.

„ 4. Young female. Dorsal view. From living animals. × 285.

„ 4*a*. Male. Lateral view. From living animals. × 317.

„ 5. Longitudinal vertical section of adult female. Oc. mag. 5. $\frac{1}{8}$ and $\frac{1}{10}$ immer. × 200.

„ 6, 7, 8, 9, 10. Successive longitudinal, horizontal sections of anterior. Six commencing immediately under the ventral surface. Viewed from the ventral. Oc. mag. 5. $\frac{1}{8}$ and $\frac{1}{10}$. o.im. × about 300.

„ 11. Trophi of young female. Drawn from a specimen dissolved out with chlorinated soda. Oc. mag. 5. $\frac{1}{10}$ immer. Dimensions: Breadth, ·05 mm.; Depth, ·02 mm.

„ 12 and 13. Vibratile tag. Flat aspect and edge view. Drawn from living animal. Dimensions: Length, ·012 mm.; Breadth, ·0025 mm. Oc. mag. 8. $\frac{1}{10}$ immer.

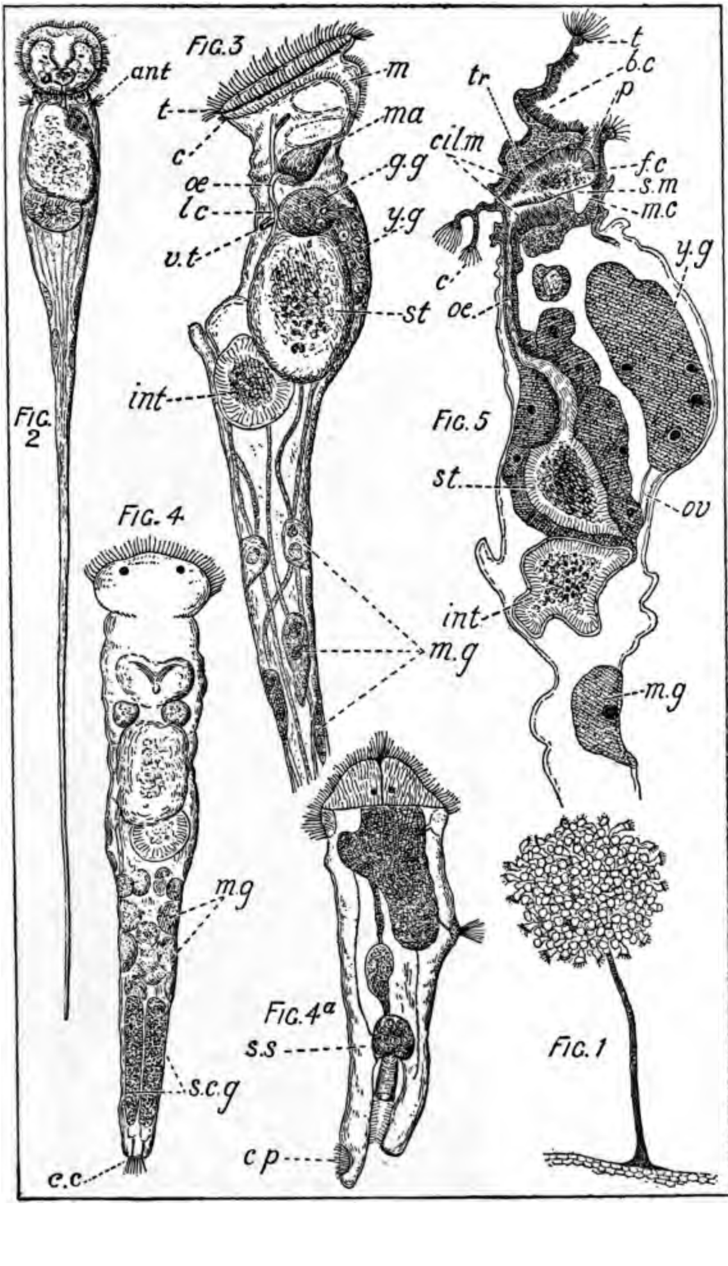
FIG. 3
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l c
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v.t
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int
FIG. 2
FIG. 4
m.g
m.g
s.c.g
c.c
FIG. 4a
s.s
c p
t
b.c
tr
p
cil.m
f.c
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m.c
y.g
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FIG. 5
st
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FIG. 1

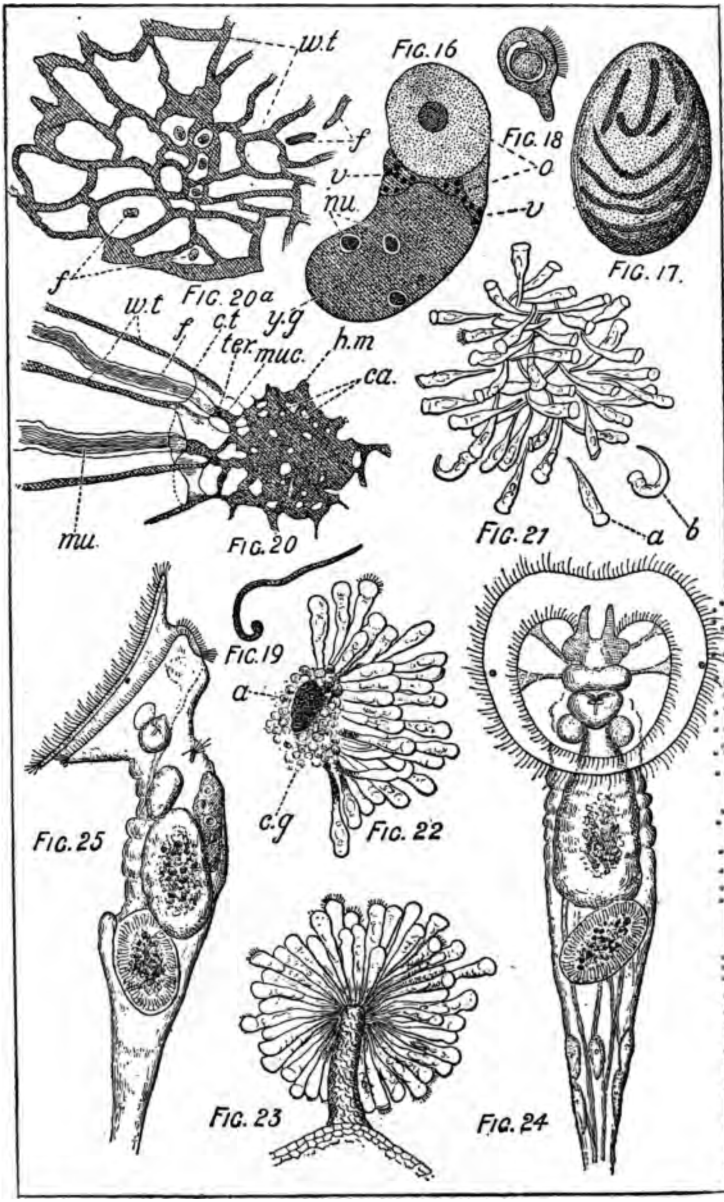
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FIG. 16
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FIG. 18
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FIG. 17.
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FIG. 20a
w.t
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ter.
muc.
h.m
ca.
mu.
FIG. 20
FIG. 21
a
b
FIG. 19
a
c.g
FIG. 22
FIG. 25
FIG. 23
FIG. 24

Fig. 14. Portion of section showing antenna. Oc. mag. 8. $\frac{1}{10}$ immer.

" 15. Transverse section of foot. Oc. mag. 8. $\frac{1}{10}$ immer.

" 16. Section through yolk gland in a plane dorso-ventral and oblique. Length, ·124 mm.; Breadth, ·05. Oc. 5. immer. $\frac{1}{10}$.

" 17. Resting egg. Drawn from preserved specimen. × 200.

" 18. Capsule with spermatozoon. Oc. mag. 5. immer. $\frac{1}{10}$.

" 19. Spermatozoon set free. Oc. mag. 5. immer. $\frac{1}{10}$.

" 20. Transverse section of peduncle and centre of colony. Oc. mag. 5. $\frac{1}{10}$ immer.

" 20*a*. Tangential section through colony. Oc. mag. 5. $\frac{1}{5}$.

" 21. Semi-diagrammatic view of swarm of young rotifers in first stage of the formation of a colony × 35.

" 22. Semi-diagrammatic view of swarm of young rotifers in second stage of the formation of a colony × 35.

" 23. Semi-diagrammatic view of swarm of young rotifers in third stage of the formation of a colony × 35.

L. pedunculata.

Fig. 24. Dorsal aspect of female. From the living animal. × 125.

" 25. Lateral aspect of female. From the living animal. × 125.

ART. IV.—*The Tertiary Deposits of the Aire and Cape Otway.*

By T. S. HALL, M.A.,

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AND

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(With Plate VI.)

[Read 13th April, 1899.]

PREVIOUS NOTICES.

In 1864, during the absence from the colony of Mr. Selwyn who was visiting England on leave, the duties of Director of the Geological Survey devolved on Mr. Aplin, the senior field geologist, and yielding to the public demand for more rapid surveys than were being executed in the careful quarter-sheet work inaugurated by his chief, he instructed Messrs. Daintree and Wilkinson, who had just completed their work in the neighbourhood of Ballan and Bacchus Marsh, to examine and report on the Cape Otway District. The only visit hitherto paid by any of the staff to the district was one made by Mr. Selwyn in 1858, when he examined the coast-line as far as Apollo Bay (1, p. 11). Before arrangments could be completed Mr. Daintree finally quitted Victoria for Queensland, and Mr. Wilkinson was placed in charge of the party, with Mr. R. A. F. Murray as assistant (2, p. 11). Wilkinson sent in a preliminary report (3 and 4) and then a more detailed one (5) accompanied by a section and map (6). Duncan reprinted (7) that part of the detailed report which dealt with what were termed the Miocene beds by Wilkinson, reproducing a part of the section but omitting some of the explanations and thus misleading Messrs. Tate and Dennant who did not consult Wilkinson's original reports (12, p. 115). In 1873 Mr. F. M. Krausé partially surveyed the country to the east of Cape Otway but does not seem to have gone further west

than Apollo Bay (9). He published a sketch map (10) in which he apparently relied on Wilkinson's survey for the details of the country about the Aire River. By neglecting a thickness in places of about 200ft. of dune rock, the æolian origin and extent of which are clearly indicated by Wilkinson, he has shown a large area occupied by the miocene of the survey. As regards the courses of the streams through the Aire Marsh Wilkinson's map, it may be mentioned, though the oldest, is the most correct; Krausé's being singularly inaccurate both here and elsewhere, a fact doubtless due to the enforced rapidity of the survey.

Mr. R. A. F. Murray, who had accompanied Wilkinson on his survey, gives in 1887 (11) a few further particulars, the outcome apparently of some unofficial visit to the Ford.

In 1895 Messrs. Tate and Dennant visited the Otway section (12 and 13), but though they report that they carefully examined the coast-line they were unable to find any of the outcrop west of the Aire indicated by Wilkinson, with the exception of the one in front of Mr. Robinson's house. As will be seen in the sequel all the latter author's localities, with perhaps one exception, are visible now just as he described them over thirty years ago.

In January, 1897, the present authors spent about a fortnight at the Aire, and found that Wilkinson's report and map were excellent guides to the locality which we purpose describing in some detail.

The mesozoic sandstones which occupy such a large area of the Otway district, are interrupted between Cape Flinders and Castle Cove by newer rocks which descend to the shore and extend inland for several miles, occupying a basin in the older series. In these newer rocks Wilkinson recognised three distinct members:—A set of marine and freshwater beds which he regarded as miocene and which in common with Messrs. Tate and Dennant we refer to as eocene; another, consisting of ferruginous conglomerates and sandstones flanking the slopes of the mesozoic rocks, capping the lower hills and which be called pliocene tertiary (5, p. 25); and lastly, the dune rock.

To the S.E. of the mouth of the Aire the coast is occupied by sand dunes with a few patches of dune rock on the beach and near the river mouth itself. In places on the front of the cliffs

the loose sand has been removed and it is seen that the greater part of the high land is formed of the consolidated rock. The dune rock occupies a large area on the Otway side of the river and the park like country is in strong contrast to the heavily timbered mesozoics further inland. Krausé has coloured the sea front as mesozoic but no trace of rocks of this age are seen between Cape Flinders and Castle Cove. On the west of the river the high sea cliffs are formed of dune rock weathered into fantastic crags and precipices, bare in some places and in others clothed with low and almost impenetrable scrub. The cliffs rise to a height of about 200ft. The eocene rocks which underlie the dune rock near Castle Cove nowhere rise to more than about 30ft. above sea level, while the high land between the sea and the Aire Marsh is almost entirely composed of dune rock of at least 200ft. in thickness. The whole of this cover is neglected by Krausé who maps it as miocene (of the survey).

Eocene.

It will be convenient to consider separately the localities which we examined.

Spud Point.

This point is formed by a small outcrop of eocene limestone which rises some 30ft. above the Aire Marsh and forms a tongue shaped area a few acres in extent. On its northern border the mesozoic rocks rise as a steep escarpment to a height of over 200ft. The outcrop is some 300 yards from Mr. Robinson's house and is the one alluded to by Messrs. Tate and Dennant. The rock consists of a yellow polyzoal limestone, the fossil fragments being much comminuted and mixed with quartz grit and pebbles up to a cubic inch in size, most of these being well rounded. The limestone is in places very hard and contains rounded concretionary masses of glazed limonite which are sometimes a couple of inches in diameter and from their resemblance to potatoes probably give the point its local name. In places a glazed deposit of limonite spreads over the joint faces in broad patches. Identifiable fossils are scarce, the rock being principally composed of worn polyzoa and stems of *Isis*. The stratification is not very clear but is apparently horizontal.

The following fossils were obtained :—

Corals.

Isis, sp.

Echinoidea.

Lovenia forbesi, Woods and Duncan.
Cyclaster archeri, T. Woods.
Eupatagus rotundus, ? Laube.
Scutellina patella, Tate.
Cidaroid spines.

Polyzoa. Abundant.

Brachiopoda.

Rhynchonella squamosa, Hutton.
Magellania grandis, T. Woods.
„ furcata, Tate.
„ insolita, Tate.
Magasella compta, G. B. Sowerby.

Lamellibranchiata.

Ostraea, sp.
Placunanomia sella, Tate.
Hinnites corioensis, McCoy.
Pecten murrayanus, Tate.
Pecten foulcheri, T. Woods.
„ sp., *aff.*, peroni.
Lima bassii, T. Woods.
Spondylus gaederopoides, McCoy.
Pectunculus laticostatus, Q. and G.
Cardium sp., *aff.*, C. hemimeris.

Gastropoda

Cypraea, sp. (casts).
Pleurotoma, sp.
Cassidaria wilsoni, Tate.
Thylacodes, sp.
Voluta, sp. (cast.)

The cast of Voluta is in the possession of Mr. Robinson of the Aire Station and is related to V. stephensi, Johnston. This is apparently the specimen referred to by Messrs. Tate and Dennant as V. mortoni, and if so is an identification which we cannot accept.

FISHING POINT.

For about a mile inland from the mouth of the Aire the country is occupied by sand dunes. For a couple of miles further the eocene rocks crop out on the low hills forming the eastern borders of the marsh. Possibly they extend a little further but the dense nature of the vegetation together with the character of the rocks as we went inland induced us to go no further than where Wilkinson had indicated the last outcrop. As far north as Fishing Point the rocks consist of clay beds intercalated with fine grained yellow limestone, gritty polyzoal rock and ferruginous grit, the grains reaching the size of a pea. Small landslips are common on the face of the low hills, and on the fresh ones we secured a fair number of fossils. The stratification appears to be quite horizontal, while with regard to the fossils it is interesting to note that Murray (11, p. 101) referred the beds to the oligocene of the survey, correlating them with those of the Gellibrand, Mornington and the Moorabool Valley, and thus indicating the close relationship which undoubtedly exists between them.

The following fossils were obtained:—

Foraminifera. Several forms.

Corals.

Placotrochus deltoideus, Duncan.
,, elongatus, Duncan.
Flabellum victoriae, Duncan.
Notocyathus australis, Duncan.
,, excisus, Duncan.
,, viola, Duncan.
Conosmilia anomala, Duncan.

Echinoidea.

Cidaroid plates and spines.

Annelida.

Calcareous worm tubes.

Crustacea.

Crab chelae.
? Balanus, sp.

Polyzoa. Common.

Brachiopoda.

Magellania divaricata, Tate.

Magasella compta, G. B. Sow.
Terebratulina scoulari, Tate
„ catinuliformis, Tate.
Rhynchonella squamosa, Hutton.

Lamellibranchiata.

Dimya dissimilis, Tate.
Placunanomia ione, Gray.
„ sella, Tate.
Pecten yahlensis, T. Woods.
„ murrayanus, Tate.
„ foulcheri, T. Woods.
„ sturtianus, Tate.
„ polymorphoides, Zittel.
„ zitteli, Hutton.
Lima bassi, T. Woods.
Spondylus pseudoradula, McCoy.
Nucula atkinsoni, Johnston.
Nuculana apiculata, Tate.
Limopsis belcheri, Adams and Reeve.
Pectunculus cainozoicus, T. Woods.
„ laticostatus, Q. and G.
Barbatia crustata, Tate.
Plagiarca cainozoica, Tate.
Cucullaea corioensis, McCoy.
Trigonia subundulata, Jenkins.
„ tubulifera, Tate.
Crassatella dennanti, Tate.
„ communis, Tate.
Cardita polynema, Tate.
„ delicatula, Tate.
Diplodonta subquadrata, Tate.
Chama lamellifera, T. Woods.
Chione cainozoica, T. Woods.
Meretrix eburnea, Tate.
Myadora tenuilirata, Tate.
Corbula ephamilla, Tate.

Gastropoda.

Typhis evaricosus, Tate.
„ acanthopterus, Tate.

Murex velificus, Tate.
„ eyrei, T. Woods.
„ trochispira, Tate.
„ amblyceras, Tate.
„ asteriscus, Tate.
„ lophoessus, Tate.
Muricidea polyphyllus, Tate.
Argobuccinum maccoyi, Pritchard.
Lotorium woodsi, Tate.
„ annectans, Tate.
„ tortirostris, Tate.
„ cyphus, Tate.
„ acanthostephes, Tate.
„ craspedotus, Tate.
„ foliaceus, Tate.
„ senticosus, Tate.
Fasciolaria decipiens, Tate.
Sipho crebregranosus, Tate.
Siphonalia longirostris, Tate.
Euthria ino, Tate.
Zemira præcursoria, Tate.
Nassa tatei, T. Woods.
Voluta hannafordi, McCoy.
„ maccoyi, T. Woods.
„ halli, Pritchard.
„ conoidea, Tate, var.
„ antiscalaris, McCoy.
Mitra leptalea, Tate.
„ paucicostata, Tate.
„ semilaevis, Tate.
Marginella propinqua, Tate.
„ winteri, Tate.
„ wentworthi, Tate.
„ micula, Tate.
„ cassidiformis, Tate ?
Ancillaria pseudaustralis, Tate.
„ semilævis, T. Woods.
Columbella funiculatus, T. Woods.
„ cainozoica, T. Woods ?

Cancellaria calvulata, Tate.
„ gradata, Tate.
„ exaltata, Tate.
„ etheridgei, Johnston.
„ varicifera, T. Woods.
Bathytoma rhomboidalis, T. Woods.
Teleochilus gracillimum, T. Woods.
Pleurotoma murndaliana, T. Woods.
„ trilirata, Harris.
„ optata, Harris.
„ clarae, T. Woods.
Drillia trevori, T. Woods.
Mangelia obsoleta, Harris (?)
Clathurella obdita, Harris.
„ bidens, T. Woods
Conus heterospira, Tate.
„ hamiltonensis, Tate.
Cypraea leptorhyncha, McCoy.
„ contusa, McCoy.
„ brachypyga, Tate.
Trivia avellanoides, McCoy.
Semicassis sufflata, T. Woods.
Cassis exigua, T. Woods.
Natica hamiltonensis, T. Woods.
„ polita, T. Woods.
„ sub-noae, Tate.
„ subinfundibulum, Tate.
„ substolida, Tate.
Crepidula unguiformis, Lamarck.
Solarium wannonensis, T. Woods ?
Turritella platyspira, T. Woods.
„ acricula, T. Tate, var.
Tenagodes occlusus, T. Woods.
Eulima danae, T. Woods.
Niso psila, T. Woods.
Mathilda transenna, T. Woods.
Cerithium apheles, T. Woods.
Newtoniella cribarioides, T. Woods.
Liotia roblini, Johnston.

Tinostoma parvula, T. Woods?
Bullinella exigua, T. Woods.
" paucilineata, Cossman.
Subemarginula occlusa, Tate.
Styliola rangiana, Tate.

Scaphopoda.

Dentalium mantelli, Zittel.
" subfissura, Tate.
" aratum, Tate.

Corals - - - - -	7
Echinoidea - - - -	1
Annelida - - - -	1
Brachiopoda - - - -	5
Crustacea - - - -	2
Lamellibranchiata - - -	31
Gastropoda - - - -	85
Scaphopoda - - - -	3
	135

The Calder Limestones.

On the northern side of a small creek which enters the marsh about three quarters of a mile above Fishing Point the strata become more calcareous and the rocks in places have a lithological resemblance to the polyzoal limestones of Waurn Ponds. In other places they are more earthy and are more than usually devoid of molluscan remains. We gathered a few fossils, most of which were obtained from a low wall of rock about fifteen feet high on the northern slope of the spur.

As at Fishing Point the strata are nearly horizontal and thus present a marked difference from the highly inclined beds of the coast sections near at hand, while the distinction is as clearly marked by the palaeontological evidence.

The following is a list of fossils found :—

Corals.

Isis, sp.

Echinoidea.

Eupatagus rotundus, Laube.
Psammechinus woodsi, Laube.
Scutellina patella, Tate.

Brachiopoda.

Magellania grandis, T. Woods.
Terebratulina catinuliformis, Tate.
Magasella compta, G. B. Sowerby.
Rhynchonella squamosa, Hutton.

Lamellibranchiata.

Placunanomia sella, Tate.
Dimya dissimilis, Tate.
Pecten yahlensis *var* semilaevis, McCoy.
„ murrayanus, Tate.
„ foulcheri, T. Woods.

The Aire Coastal Sections.

For a little more than half a mile westward from the river mouth nothing but dune rock is seen on the beach which is impracticable except at low tide, and even then the passage is rough, as the enormous blocks of dune rock, weathered into sharp points, lie piled in the wildest confusion. Then a small sandy bay is reached, to which we afterwards found access could be easily gained from the downs above. The best way to reach it is to follow a fence which runs to the edge of the cliffs from the stockyard which is situated on the landward slope. About two hundred yards west of the fence a cattle track goes down to the beach. On the eastern side of the bay among the tumbled blocks of dune rock is a small exposure of black clays. This lies on the shoreward side of a prominent pinnacle, about thirty feet high, which is probably what is marked as the Sentinel Rock on Wilkinson's map. The strata consist of black and grey sandy clays with pyrites, gypsum and what appeared to be copiapite.

There is in places a good deal of carbonaceous matter, and the well-rounded sand-grains are at times as large as a pea. There is about twenty-five feet in vertical thickness exposed, and the outcrop is about a chain in length. We could not find any beds showing beneath these clays, and as the dip is E. 35° N. at 12°, the reverse of Wilkinson's observations, it is evident that it is not

the outcrop which he noted and which we were unable to discover. (5, p. 23). As that author points out the physical appearances of the deposit are the same as those of the Point Addis clays on which the polyzoal limestone rests and he referred both to the same horizon. A few chains S.E. of this point we found a loose block of Eocene limestone containing an umbilicated *Nautilus* about six inches in diameter and *Trigonia subundulata*, but could find no outcrop.

WILKINSON'S No. 4 LOCALITY.

About three quarters of a mile west of the outcrop of lignitic clays polyzoal limestone crops out extensively on the beach and is Wilkinson's No. 4 locality. The beds dip south-easterly, the strike being at right angles to the coast-line, and as hard and soft beds alternate fairly regularly the platform of rock which is exposed by the falling tide is furrowed like an old ploughed field and presents a striking dissimilarity from the dune rock which occurs elsewhere in the neighbourhood. A belt of sandy beach, fifteen yards wide, intervenes between this platform and the deposit at the foot of the cliffs where the tabular masses rise as high as one's head and are crowded with fragmentary fossils. To the N.W. the limestone overlies argillaceous rocks, of which there is only a small outcrop rising not far above extreme high water mark. The section from above downwards is :—

54ft.	0in.	of polyzoal limestone with softer bands; full of quartz, grit and rounded pebbles.
	6in.	concretionary limonite with well rounded quartz pebbles.
2ft.	0in.	clay and limestone.
	6in.	limestone.
1ft.	6in.	grey clay.
	6in.	gritty limestone.
3ft.	0in.	grey clay.
1ft.	0in.	yellow limestone with polyzoa.
	6in.	clay.
	9in.	yellowish limestone.
	6in.	grey clay.
1ft.	0in.	concretionary limestone with brachiopods and echinoids.

	3ft. 6in.	grey clay with *Turritellas.*
	1ft. 0in.	fawn coloured limestone.
	4ft. 0in.	grey sandy clay, rich in fossils.
	1ft. 0in.	grey clay with abundant polyzoa.
	2ft. 0in.	fawn coloured hard limestone with small pockets of clay, with polyzoa, brachiopods and corals.
	15ft. 0in.	dark grey clay, cutting like new cheese and becoming very hard on drying. Fossils scarce, principal ones Turritella aldingæ scaphopods and pteropods with large unbroken pieces of delicately branched polyzoa.
Total	92ft. 3in.	

The dip of the beds is S. 25° E. and varies from 18° to 20°.

The following fossils were obtained :—

Corals.

Graphularia senescens, Tate.
Conosmilia striata, Duncan.
Placotrochus elongatus, Duncan.
Notocyathus viola, Duncan and Woods.
Flabellum distinctum, Edw. and H.
Balanophyllia campanulata, Duncan.
„ selwyni, Duncan.
„ cylindrica, Michelotti.
Cycloseris tenuis, Duncan.

Echinoidea.

Cidaris (Leiocidaris) australiae, Duncan.

Brachiopoda.

Terebratula vitreoides, T. Woods.
Magellania insolita, Tate.
Terebratulina triangularis, Tate.

Lamellibranchiata.

Pectunculus cainozoicus, T. Woods.
„ laticostatus, Q. and G.
Myadora tenuilirata, Tate.
„ lamellata, Tate.
Cardita polynema, Tate.
„ delicatula, Tate.

Cardium victoriae, Tate.
Pinna cordata, Pritchard ?
Fossularca equidens, Tate.
Trigonia subundulata, Jenkins.
Limopsis insolita, G. B. Sow.
Dimya sigillata, Tate.
Meretrix tenuis, Tate.
Tellina masoni, Tate.
Corbula pixidata, Tate.

Gastropoda.

Natica wintlei, Tate.
Voluta anticingulata, McCoy.
Turritella aldingae, Tate.
" conspicabilis, Tate.
Fusus acanthostephes, Tate.
Lotorium tortirostris, Tate
Marginella wentworthi, T. Woods.
Borsonia otwayensis, Tate.
Scalaria pleiophylla, Tate.
Mesalia stylacris, Tate ?
Dentalium mantelli, Zittel.
" subfissura, Tate.

The whole of these fossils occur in the "4ft. of grey sandy clay, rich in fossils" mentioned above in the description of the section.

For 250 yards along the beach to the north-west the clay beds are covered by loose sand and dune rock when the next outcrop of eocene rocks is met with.

Wilkinson's No. 3 Locality.

The rock, a gritty polyzoal limestone, shows as a small cliff 20ft. high, from which a platform runs seawards with westerly facing scarp which extends breast high above the sand and which has to be climbed over when going along the coast. The dip is N. 40° W. at 12°.

From here to Castle Cove the beach is formed of huge blocks of dune rock and progress is slow and painful, as the rock weathers into very hard jagged points.

The following fossils were found at this place (No. 3) :—

Corals.

Graphularia senescens, Tate.

Echinoidea.

Scutellina patella, Tate.
Lovenia forbesi, Woods and Duncan.
Echinobrissus vincentianus, Tate.
Cassidulus australiae, Duncan (Echinobrissus).

Brachiopoda.

Magellania grandis, T. Woods.
„ garibaldiana, Davidson.
Magasella compta, G. B. Sowerby.
Terebratulina catinuliformis, Tate.
Crania quadrangularis, Tate.
Rhynchonella squamosa, Hutton.

Lamellibranchiata.

Pecten foulcheri, T. Woods.
„ murrayanus, Tate.
„ yahlensis *var* semilaevis, McCoy.
„ hochstetteri, Zittel.
„ peroni, Tate.
Hinnites corioensis, McCoy.
Limatula jeffreysiana, Tate.
Spondylus pseudoradula, McCoy.
„ gæderopoides, McCoy.

Mammalia.

Squalodon wilkinsoni, McCoy.

NOTE.—Wilkinson, who found the specimen, says this is the locality where the type of Squalodon wilkinsoni was found. Sir Frederick McCoy quotes it as from Castle Cove, which of course is quite close at hand.

CASTLE COVE (WILKINSON'S NO. 5).

The fossiliferous rocks here form a cliff 30ft. high scantily overgrown with small shrubs, and extend for about one and a half chains along the beach. The dip is E. 38° S. and varies in amount from 35° to 40°. The lowermost beds consist of grey clays in thin irregular beds intercalated with hard detrital limestone consisting of comminuted fragments of polyzoa and shells. The limestones become more persistent as we pass up and are here full of brachiopods and joints of Pentacrinus, becoming more ferruginous at a higher level and containing numerous small

quartz pebbles. Overlying the limestones, and apparently conformable to them, is a series of unfossiliferous grey sands with plentiful spangles of white mica up to a quarter of an inch in diameter. These pass up into hard ferruginous grits which dip to sea level on the east and cap the mesozoic rocks on the west. Though apparently quite conformable to the high dipping Eocene it is possible that these grits are much younger than they. If they are Eocene then much of the inland gravel and grit capping of the mesozoic with which they seem continuous will be far older than Wilkinson considered it. The actual junction of the fossiliferous beds with the mesozoic is hidden by drifting sand, and over this the path to the beach passes.

An examination of the list of fossils from this locality shows that a number hitherto known only from Aldinga occur, while at the same time the relationship to the Spring Creek lower beds is pronounced; in fact the Castle Cove section emphasises the close faunal resemblance between Spring Creek and Aldinga.

The fossils occurring are as follows:—

Corals.

Flabellum distinctum, Edw. and Haime.

Echinoidea.

Leiocidaris australis, Duncan.
Cassidulus australiæ, Duncan. [(Echinobrissus) Type locality.]
Eupatagus coranguinum, Tate.
Hemiaster planedeclivis, Gregory.

Crinoidea.

Pentacrinus stellatus, Hutton.

Brachiopoda.

Terebratulina triangularis, Tate.
Magellania pectoralis, Tate.
,, insolita, Tate.
,, tateana, T. Woods.
Crania quadrangularis, Tate.
Terebratula aldingæ, Tate.

Lamellibranchiata.

Gryphaea tarda, Hutton.
Pecten peroni, Tate.
,, yahlensis, T. Woods.
Chione cainozoica, T. Woods.

Chione halli, Pritchard.
Cardita polynema, Tate.
Myadora lamellata, Tate.

CAPE OTWAY.

A list of fossils from this locality has been published and discussed by Messrs. Tate and Dennant, and the beach exposure was briefly described by them (12 and 13). Inland from the coast about half a square mile of swampy land occurs surrounded by high sand dunes. The streams draining from these swamps run over the sea front of the beds which consist entirely of slipped material which has in places flowed out like thick porridge and in this are mingled dune rock, recent shells blown up from the beach and fossils. The only eocene rock we could find *in situ* was about 200 yards from the beach where a small runnel had cut down through the peaty soil to yellow clay with a few fossils in it; but no sign of stratification could be seen owing to the small extent of the exposure.

On the coast-line the mesozoic rocks rise sharply to the south-east and above the level of the eocenes and occupy the coast-line as far as Point Castries, some six miles north-east of Lorne.

An examination of the details given above of the beds exposed at Wilkinson's No. 4 locality will show that during the deposition of the series there, a gradual shallowing of the water took place. The lowermost beds are fine grained and compact and almost the only fossils are beautifully perfect pieces of polyzoa, the long delicate branches of which are unbroken, thus pointing to comparatively undisturbed depths. As we pass up through the series the rocks become coarser till we reach the uppermost beds exposed, the polyzoal limestone, which is full of quartz grit and rounded pebbles. Thus we see that a polyzoal limestone may be deposited in quite shallow water close to land and we may then consider what evidence there is that the limestones of our tertiary beds represent deep water deposits and that the clays represent strata laid down at lesser depths, a conclusion arrived at by Duncan and adopted by many subsequent writers. Our polyzoal limestones are composed of fragments of all sorts and

mostly broken into small pieces. Foraminifera are frequently common, and occasionally constitute the bulk of the rock, as at Batesford and the Grange Burn where the large Orbitoides and Nummulites lie at all angles. In other places fragments of polyzoa form the mass of the beds, with scattered and frequently worn spines of echini, joints of isis, brachiopods and the like. Echinoids, when unbroken, are as often upside down as not and in fact as far as the condition of the organic remains is concerned it points to deposition in shallow water where considerable movement has taken place. But besides this in almost every place where a careful description of the rock has been given we find undoubted traces of coarse detrital matter derived from the land. At Waurn Ponds coarse grits and sandy clays are intercalated with the limestone. Fragments of felspar, quartz and mica are common, derived evidently from the granite area which is partly exposed a few miles to the north-west, and in places the rock is well current-bedded, a feature clearly displayed in many of the blocks of this widely used building stone. At Batesford the polyzoal limestone passes down in places into current-bedded orbitoides limestone and this in its lower part rests on granite and contains numerous granite pebbles. The Lower Maude limestones, which are polyzoal in places, pass down into sands and conglomerates, while the similar limestones of the upper beds contain rounded boulders and pebbles of the underlying volcanic rock. Exactly the same features are shown in the cliffs at Airey's Inlet where an eroded volcanic rock underlies the polyzoal limestone which fills deep pockets and chasms in its surface. On the Grange Burn, near Hamilton, the limestone again is plastered down into the crevices and clefts of the igneous rock. The same thing again occurs at Flinders, Curlewis and Keilor, in fact in almost every place where the underlying beds are exposed we find that polyzoal limestone was the first deposit to be laid down, and even when the basalt beds cannot be seen quartz grit is present in the calcareous beds, as at Aldinga, Spring Creek, Shelford, Point Addis. There are of course places where the contact of the eocene with the underlying older rocks is seen and yet no limestone is found, as at Royal Park and Table Cape, but this in no way detracts from our contention for the shallow-water nature of the polyzoal limestone.

Professor Martin Duncan in speaking of our tertiary rocks says: "Pure limestone, except in the upper part of the series is rare; it contains there an abundance of polyzoa, and is a deep-sea deposit" (7, p. 286). In considering that part of this statement with which we are at present dealing, it must be borne in mind that ideas as to what constitutes a deep-sea deposit have greatly changed since Duncan wrote this, nearly thirty years ago. In the same volume of the Quarterly Journal his remarks show (pp. 54 and 70) that he applies the term deep-sea deposit to anything over ten fathoms, while for the great depths, then being for the first time explored, he would employ the term abyssal.

The organisms, of which the remains constitute the bulk of the rock, probably lived in places where, though the water might be many fathoms deep, yet strong currents prevailed, just as at present the strongly calcareous polyzoa exist in the greatest profusion with us at such places as Port Phillip Heads and the entrance to Western Port, where the tide-current runs most strongly and deposition of fine sediment cannot take place. Limestones of a similar nature are now forming apparently in the shallow waters in the neighbourhood of coral atolls as described by Dana (19, p. 121), and more especially by subsequent writers on the Lagoon of Funafuti. Professor T. W. Edgeworth David has told us orally that the floor of the lagoon is in many places covered with a thick deposit of foraminifera which are even now in parts being cemented into a solid rock. There is nothing then in the nature of the organisms, the remains of which build up our polyzoal limestone, and the foraminiferal limestone into which it in many places passes, which demands deep water for their growth, while the physical nature of the deposit, composed as it is of worn and broken fragments of considerable size, is clearly an indication of its formation in very shallow water or in places where strong currents run.

One of the most interesting points about the eocenes of the Aire, is the existence close together of two clearly distinct faunas. The fauna at the Otway section has been already dealt with by Messrs. Tate and Dennant, and its strong likeness to that of Aldinga has been noted by them (12, p. 113), and the Castle Cove section belongs to the same horizon. In contrast to the fauna of these beds is that displayed at Fishing

Point, which resembles that of Fyansford and Mornington, a resemblance which it is interesting to note, is already recorded by Mr. Reginald Murray in his Geology of Victoria, where he calls the beds about a mile inland, on the east side of the Aire, oligocene (11, p. 101); while he calls the other tertiary beds of the district, miocene (11, p. 103). Both sets are now generally regarded as eocene, though differences in the faunas exist.

As regards the relationships of the two sets of beds, the sections in this locality supply no conclusive evidence, since no junction is visible. The fact that the sections on the coast, near Castle Cove, are acutely folded, and show great variations in strike at the three localities, might be taken as evidence that the horizontal beds of Fishing Point unconformably overlie them. The Castle Cove series is undoubtedly the older, but it is more probable that the disturbance of the beds is merely a local phenomenon, and that the subsequently removed upper series partook in the folding, which ensued close to the flanks of the mesozoic. Whether a similar disturbance took place on the Otway side of the eocene is uncertain, as no clear outcrop of rock *in situ* is visible.

Evidence as to the succession of the beds then not being available here, we must look elsewhere for it, and we find it, as we have previously shown in the Moorabool Valley, where strata, with a strong Spring Creek facies, underlie the oligocene of the survey. We subsequently grouped the Aldingan and Otway beds with those of Spring Creek. Our opinions were objected to by Messrs. Tate and Dennant, who, in the same paper, arrived at the conclusion that the Aldingan and Otway beds represented an age anterior to that at which the Lower Muddy Creek beds were deposited, thus essentially agreeing with our previously published remarks.

The Newer Rocks.

There is nothing much as yet to be added to Wilkinson's remarks on the newer rocks as displayed in the Otway district. The pliocene of the survey, the greater part of which is now generally regarded as miocene, has not hitherto yielded any fossils in this locality, and is apparently ascribed to pliocene age on strati-

graphical evidence only. Wilkinson says (5, p. 25) that: "it occurs at intervals all round the Otway Coast Range, resting on the flanks of it, and at greater elevations than the older tertiary just described, though I have not observed it at a greater altitude than about 1,000 feet above the sea. South of the Dividing Range, we first meet with it at Point Bunbury, Apollo Bay; thence it continues westward to Moonlight Head, capping, more or less, the intervening ranges from one to six miles inland. From Moonlight Head it extends nearly as far west as Warrnambool, resting unconformably on the miocene (*i.e.*, of the survey, H. and P.!) On the north side of the Coast Range we have it, until it passes under the lava plains." He then describes the variations in the deposit in different localities, and mentions a curious coarse conglomerate, which occurs about ten miles up the Gellibrand, and which consists of granite, porphyry, mica-schist, quartzite, and very little true quartz. As far as is known there are no outcrops of ancient rocks in the Otway Ranges which could yield a conglomerate of this nature, in fact, its character as far as can be judged from this brief description, is such as we should expect to find in beds derived from the widely spread palæozoic glacial conglomerate of the southern parts of Australia, a fact to which one of us has previously drawn attention (20, p. 174).

With regard to the dune rock and the sand dunes, Wilkinson's descriptions are very full and accurate. He refers them to post pliocene age in his report and section. Duncan (7, p. 291) reproduces a part of this section, but in the legend omits the words, "post pliocene;" after "*b.* irregularly stratified yellow calcareous sandstones;" moreover, "*h.* brown sand," should read "blown sand." Wilkinson on page 23 of his report, speaks of the dune rock as "more recent tertiary sandstone," evidently regarding the post pliocene formation as a sub-division of the tertiary, a point in which he is of course in agreement with many recent geologists. In his letter to Aplin (4, p. 14), in speaking of these beds, he says: "the bed of lignite is of too limited extent to be of any economic value. It appears to be of very recent tertiary age, and the thick deposit of irregularly laminated calcareous sandstone which overlies it, I believe to be consolidated blown sand." In his report (5, p. 24) he says:

"This" (*i.e.*, 'post pliocene formation' H. and P!) is of no very great extent until we get to Warrnambool, which town is built on it. . . . South of a line drawn about a mile and three-quarters up the Parker River to a point about three-quarters of a mile up the Aire River, and the piece of land between that portion of the Aire Marsh through which the Ford River runs, and the coast as far west as Castle Cove, may be taken as the extent of this deposit at Cape Otway." Further particulars are given of the deposit as far west as Warrnambool, and for these as well as for remarks on the estuary deposits and sand dunes of the coast, reference must be made to his report.

SUMMARY.

The eocene beds of the Aire and Cape Otway occupy a small triangular area of about six square miles. For the greater part of their extent they are hidden by more recent deposits, which for the most part consist of estuarine or æolian beds so that the only outcrops are on the shore line or along the hills which bound the Aire Marsh. On their east and north-west borders they are hemmed in by the fresh-water mesozoic rocks of the Cape Otway series, which rise high above them as lofty hills, so that they perhaps owe their present position to faulting. The beds on the shore line near Cape Flinders, which are generally spoken of as the Cape Otway beds, and those in the neighbourhood of Castle Cove are older than those bordering on the Aire Marsh, the faunas of the two being in strong contrast. The occurrence of these two faunas so close together in the same neighbourhood shows that the differences between them are not due, as has been suggested, to geographical position, while as the lithological characters of the deposits show no striking contrasts, it cannot be that these differences are due to bathymetrical conditions. It follows then that the differences are dependent on difference in age, a point on which we have always insisted in our discussions on the sequence of our eocene strata. The disturbed condition of the deposits in the neighbourhood of Castle Cove, with their high dip and varying strike, possibly affords evidence that they underlie the horizontal beds displayed in the river sections, and if so this evidence is in accord with

that which we found at Maude and which led us to place the Spring Creek series beneath that of Mornington and Muddy Creek, this being the reverse of the reading of the old Geological Survey.

A discussion of the character of the polyzoal limestones leads us to the opinion that they are essentially a shallow water deposit, and not, as has been usually stated, the deep water representative of the argillaceous beds.

LITERATURE.

1. *Selwyn, A. R. C.*—"Reports relative to the Geological Survey of Victoria," 1861. Votes and Proc. of the Leg. Assem. of Victoria, 1861-2, vol. i. (1862).
2. *Aplin, C. D'O. H.*—"Report," etc. Pap. Pres. to. Parl., Session 1864-5, vol. iv., pp. 9-20.
3. *Wilkinson, C. S.*—"Letter to the Acting Director of the Geological Survey," 25th July, 1864.
4. *Wilkinson, C. S.*—"Letter," etc., 26th Sept., 1864.
5. *Wilkinson, C. S.*—"Report on the Cape Otway Country," with a sketch section.

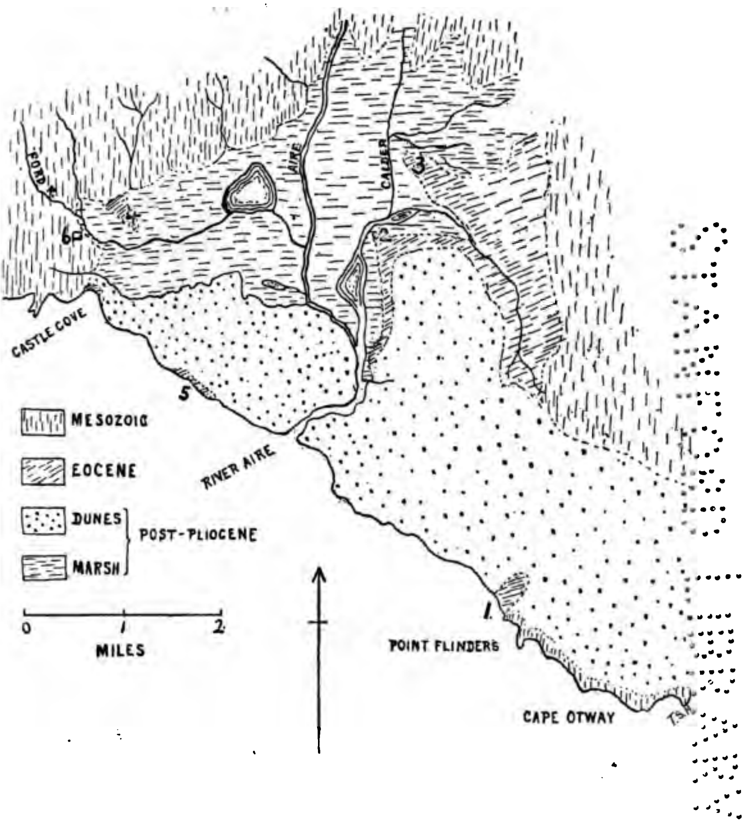
[These three articles were published in Papers Pres. to Parliament, Session 1864-5, vol. iv. The two letters also appeared in the *Argus* of 5th Aug. and 5th Oct. respectively of the same year.]

6. *Wilkinson, C. S.*—Map of Part of the Counties of Polwarth and Heytesbury, Cape Otway District. Pap. Pres. to Parl., 1866.
7. *Duncan, P. Martin*—"On the Fossil Corals of the Australian Tertiary Deposits." Q.J.G.S., xxvi., (1870), pp. 284-318.
8. *Duncan, P. Martin*—"On the Echinodermata of the Australian Cainozoic (Tertiary) Deposits." Q.J.G.S., xxxiii. (1877).
9. *Krausé, F. M.*—Report Cape Otway District. Geol. Surv. Vict. Rep. of Progress, I. 1874, pp. 99-109.
10. *Krausé, F. M.*—Geological Sketch Map of the Cape Otway District. Melb., 1874.
11. *Murray, R. A. F.*—"Geology and Physical Geography of Victoria." 8°. Melb., 1887.

12. *Tate, Prof. R., and Dennant, J.*—"Correlation of the Marine Tertiaries of Australia, Pt. II." Trans Roy. Soc. South Australia. 1895.
13. *Dennant, J.*—"Notes on a Trip to Cape Otway." Geelong Naturalist, V. (1895), pp. 4-7.
14. *McCoy, Prof. Sir Fredk.*—"Prod. Pal. Vic." Dec. V. pl. 1.
15. *Hall and Pritchard.*—"The Older Tertiaries of Maude" etc. Proc. Roy. Soc. Vic., N.S., vii. 1895.
16. *Hall and Pritchard.*—"Remarks on the Proposed Subdivision of the Eocene Rocks of Victoria." *Ib.* viii., 1896.
17. *Pritchard, G. B.*—"On the Present State of our Knowledge of the Older Tertiaries of Southern Australia." Report Aust. Ass., etc., Brisbane, 1895.
18. *Pritchard, G. B.*—"A Revision of the Fossil Fauna of the Table Cape Beds," etc. Proc. Roy. Soc. Vic., N.S., viii.
19. *Dana, J. D.*—"Corals and Coral Islands." Lond., 1875.
20. *Hall, T. S.*—"Note on the Glacial Beds near Heathcote." Victorian Nat., viii., p. 172.

EXPLANATION OF MAP.

1. Otway Section.
2. Fishing Point.
3. Aire Limestones.
4. Spud Point.
5. Aire Coastal Sections.
6. Aire Cattle Station Homestead (Robinson's).



MAP SHOWING TERTIARY ROCKS NEAR CAPE OTWAY, BASED ON WILKINSON'S MAP.

ART. V.—*Notes on Malurus gouldii and Malurus cyaneus, with special reference to changes in plumage.*

BY ROBERT HALL.

[Read 11th May, 1899.]

To identify the two species with which this paper deals, a key is given by Dr. Sharpe in vol. iv. of the Brit. Mus. Cat. Birds. which, on carefully comparing with many specimens in my cabinet, I find is particularly useful as regards the characters of the blue coloring ; but the various measurements seem to differ so much in some thirty skins I have handled, that the key to the species seem to me to be the nature of the blue color of the male bird.

The British Museum keys are :—

Malurus cyaneus, Ellis.—Head, blue ; throat, blue-black ; upper tail coverts black, smaller than *M. gouldii* ; wing, 1·95" ; head, ear-coverts and mantle turquoise blue.

Malurus gouldii, Sharpe.—Head, blue ; no red on upper surface ; throat, blue-black ; upper tail coverts, black ; larger than *cyaneus* ; wing, 2·15" ; head, ear-coverts and mantle rich cobalt-blue ; mantle more extended than in *M. cyaneus.*

Taking first the difference in the length of wing I cannot see the character is sufficiently strong as a leading one to constitute a part of a basis for us to identify the species. Of mature birds the wings measure :—

M. cyaneus.

a. - - -	1·9".
b. c. d. -	1·95".
e. f. - -	2".
g. - - -	2·2".

Range from 1·9" to 2·2".

M. gouldii.

a. b. c. d. -	2".
e. f. - - -	2·05".
g. - - -	2·1".
h. - - -	2·15".

Range from 2" to 2·15".

In the mantles I see no regular comparative difference in the measurements. Adult birds (*M. cyaneus*), from the same paddock in county Evelyn, and adult birds (*M. gouldii*) from the same locality in county Heytesbury (150 miles apart), give depth of mantle ·4" to ·75", and the mantle varies in how near the centre of the throat it may approach. I do not see any order in the extension of the mantle that severs the likeness in the two species.

M. gouldii, as a whole, in any stage does not seem to me to be larger than *M. cyaneus*, and I give, as under, some measurements of three stages of *M. cyaneus* that appear to correspond with equal stages of *M. gouldii.*

A. ♂. Juv. 31/7/96, Box Hill, Vic.: Bill, chocolate-brown; tail, light blue; plumage generally brownish. Total length, 4·75"; wing, 1·95"; tail, 2·4"; tarsus, ·85".

B. ♂. Box Hill, Vic.: Under 12 months, 4/8/94. Total length, 4·75"; wing, 2"; tail, 2·5"; tarsus. ·9".

C. ♂. ad. 18/9/94, Box Hill, Vic.: In full nuptial plumage. Total length, 5·75"; wing, 2·2"; tail, 2·6"; tarsus, ·85".

The distinct difference between the two lies in the head, ear, coverts and mantle of one being rich cobalt-blue, and turquoise in the other.

No previous literature with which I am acquainted makes any reference to a conspicuous greenish-blue on the secondary quills of either species. This seems to be quite right as concerns *M. cyaneus*, for in sixteen male birds in my cabinet, not one has this color on the edges of the outer webs of the secondary quills. In eleven specimens of *M. gouldii*, the most matured skins have this character varying in intensity. Other naturalists may have skins of *M. cyaneus* showing this greenish-blue, but if not it will distinctly define the adult male of *M. gouldii.*

Wrens in their autumn plumage are confusing in the sexes, for, at this time of the year all are much alike, as will be conclusively proved further on. The young female is similar to the old female excepting in the tail, the latter being blue, the former brownish. The young male, as well as the old male, in the critical parts (moulting) of the year, are somewhat like each other, and like the female in the distance. The lores of the

young male are brownish which, in the old male, are black. In both young and old female they are rufous. The older the female the deeper the blue of the tail. In skins *a. b. c.*, collected on 4/8/94, 15/7/96, 1/11/96; the tails quills are brown. In a brown male shot 26/8/93, the bill and tail were like those of a female, but the lores were different. Young and old of both sexes in irregular dates of the autumn are alike, brownish, and this sombre attire of each sex, but for the lores, would, sometimes, confuse the observer with the best of field-glasses.

A. *Previous references.*

The late Mr. John Gould, while writing on the genus Malurus, in his "Handbook to the Birds of Australia," remarks:—"The gay attire is only assumed during the pairing season, and is retained for a very short time, after which the sexes are alike in coloring." Continuing, he says, "During the months of winter it associates in small troops of 6—8 in number, which continually traverse the district in which they were bred. At this period of the year the adult males throw off their fine livery, and the plumage of the sexes becomes so near alike that a minute examination is requisite to distinguish them."[1]

"Relative to the above statements, that the males of the genus Malurus only assume their full plumage during the pairing season, and that the adult males throw off their fine livery in winter, and can hardly be distinguished from the females—Gould is decidedly in error." So writes Mr. A. J. North,[2] following on with some observations in justification. With the first part of Mr. Gould's theory I agree in part, and only so because all facts away from the main issue have not been recorded by this great ornithologist. I am well able to prove that the full livery is obtained in autumn as well as in spring in different specimens, though not to such an extent in the former as in the latter. With the second part of his observations I take exception only to his statement of the period of moult being winter instead of autumn principally. In all this I am opposed to the theory of Mr. North. I have observed the same as Mr. North as regards seeing full plumaged males at the end of May and monthly up to

1 Gould. Handbook Birds of Australia, vol. i., pp. 317-18.
2 P.L.S. N.S.W., vol. v., 2nd series, p. 505.

August, but the moult of blues takes place months before this, and the blues are in fresh supply again by the end of May and later (when birds are assuming blues in spring).

Mr. North quotes records given him by Mr. Geo. Masters and Mr. Geo. Barnard, with which I quite agree, but a reference to the skins as under will clearly show that the remarks of these gentlemen are not definite enough, for "winter" only is mentioned. Mr. North quotes facts and opinions of Mr. K. H. Bennett on the Maluri, and had this gentleman gone further in his research he would, in my opinion, have discovered the true state of affairs. Mr. North also quotes the opinion of Dr. Ramsay, that, in the section of the genus in which the blue predominates, the males having once attained their full adult plumage always retain it; but does not feel quite so certain about the members of the red-backed species.

Mr. J. R. McClymont[1] also takes exception to Mr. Gould's "blue-birds" not being seen in winter, and here this gentlemen also stays his hand.

Mr. F. G. Aflalo writes[2] of the Maluri, which he has watched throughout the winter months in the Sydney gardens, as only attaining the bright plumage during breeding season.

The late Mr. Diggles in his "Ornithology of Australia," speaks of the male of *M. longicaudus (gouldii)*, losing its bright plumage during the winter months. This, again, is only partly true, and I am not quite sure he knew the species, as both figure and letterpress are incorrect as regards the most important point, the blue—reversed in *M. cyaneus*, plate 27.

Mr. Belcher, in the "Geelong Naturalist," writes:—"Mr. Mulder has proved that the male does not attain its full plumage till the second or third year. Male birds of immature plumage have been found breeding."[3] I will at once comment upon this. I understand the maturity referred to, to mean full blues on head, mantle and cheeks. If the male takes 2—3 years to attain its conspicuous plumage, why does it drop the same on the fourth and each succeeding year? I say the fourth and each succeeding

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1 Roy. Soc. Tas., 1887, p. 111.

2 A sketch of the Natural History of Australia, p. 136.

3 Mr. J. F. Mulder communicates to me, 18/4/99, his doubt of the verity of this previous statement, but suggests no alteration.

year, because Mr. Graham and I have carefully tested two districts, in which *M. cyaneus* and *M. gouldii* are separately to be found, and we find 99% of the wrens are brown by the end of summer, the remaining 1% being "blue." Then, as to observing an immature bird going through the stage of rearing young, I have some doubt, because of the regular attention one brood of young gets from 2—3 adult males as mentioned in the part following on nidification. Such an immature bird could easily be one of these three. Besides, I do not believe a female wren would mate with a half liveried male. In the bird referred to below as that under domestication, the young male actually did assume half a blue dress in its first spring.. It went no nearer to maturity, and moulted it in the following autumn.

I do not think there is throughout our continent a bird that has hoodwinked us more or has made more champions "for and against" an annual change in its life-history than the blue wren. Without doubt I consider the annual double moult of the male wren to be now an established fact as contended for by Mr. Gould in the first place, but in a fuller sense by the following original observations.

The species specially chosen by myself is *M. gouldii*, a representative of the blues, which I judge by analogy, will embrace a moult of the bright feathers in all the other "black-backed," if not the "red-backed" section as well.

B. *Birds at large.*

That the male moults its blue coat once in a year is proved in the following, not only by many specimens procured and preserved, but by a bird in captivity. That the male dons its "blue" either in autumn or spring I find demonstrated in the skins procured.

Moulting processes takes place in :—

A. "Blues" falling from late summer to the first of autumn.
B. "Browns" falling in (*b'*)—Early autumn.
(*b''*)—Spring.

In the autumn none but singing birds are affected, the young still holding their little chirps and their brownish bills and legs. I have skins of male birds developing their nuptial plumage in April, May, July, August, and on to Oct. 25th. The spring is the

time when the moult of brown is strong. As described later, one bird shews the acquisition of both "blues" and "browns" in March, as if a war was being carried on for the mastery. I consider the "browns" would have gained, though this skin still remains an oddity. The change of bill from brown to black appears to be a spring move, and according to the large number of moulting birds in March—April, the act evidently is confined to birds at least 15 months old, judging by the color of bills.

Adult males represented with their "blues" become scarce by early April, nevertheless they are easily detected while brown as leaders of families.

During the winter months it is not unusual to count ten—twelve birds, of which only one is in livery, or a group of five (*M. gouldii*) to six (*M. cyaneus*) ordinary brown birds foraging along a creek bank; but it is quite apart from the ordinary to count twenty-seven sombre colored birds (*M. cyaneus*), in one brake of thicket, with a possible three or four more. In June, 1897, I was favored with a sight of this large group of what our boys call the "blue-tit," when the leader flew away with nineteen as immediate followers in single file, and the remainder, feeling themselves disbanded, with very little hesitation, followed in pursuit of the first contingent. There were no blue birds! If there are no "blues" in a flock of twenty-seven would there be any in a district association of one hundred? This was the question I set Mr. Graham to unravel—which was answered satisfactorily. In the 1897 winter a thorough search was made through a portion of Heytesbury, with the result that 1 adult male in 100 brown birds could not easily be found. In 1898 this was modified to 1—100 birds. The ratio stands also for 1st April of this year. From this I conclude, as far as *M. gouldii* is concerned, that the bird which obtains its "blues" in autumn is in the ratio of 1 to 100 brown males and females, and 1 to 20 in males that don the "blues" in spring. If the nuptial plumage is put on during the late autumn, it is doubtless retained throughout the winter on to early in January, when precocious birds moult their blues as is shown in one skin in my cabinet.

With regard to the time necessary to a moult of "blues," Mr. Graham gave his most careful attention in set parts of each

day for weeks, and found the act took effect between 14th Feb. and 14th March in 1897 and 1898, lasting sixteen days from the time the change is noticeable till the summer plumage had disappeared (*M. gouldii*). Certain families were shepherded in the same place each day, and they each kept to the haunt of the season's nest. So tame did those in his garden become, that they (♂ and ♀) were handled three times in order to follow the process of moulting.[1] Other male wrens (*M. cyaneus*), appear to me to take less time in the moult; but as I lost their identity, I also lost confidence in the verity of the observation.

This season (1898-99), Mr. Graham's garden wren moulted its "blues and blacks" in early February and resumed a similar dress between 24th April and 10th May.

In an examination of eleven male skins of *M. gouldii*, that are undergoing a change in plumage from "blue" to "brown" or *vice versa*, I find the following results :—

Males losing "blues."—Summer to autumn, 4. (Specimens, 1—4.)

Males gaining "blues," 6. { Summer to autumn, 3. (Specimens, 5, 9, 10.)
Spring, 3. (Specimens, 7, 8, 11.)

Males gaining "blues and browns" at the same time. Autumn, 1. (Specimen, 6.)

Specimen 1.—Immature male, 3/3/97. Brown feathers of head, cheeks, mantle and other parts are coming and have lately appeared. Blues and blue-blacks are not coming just now, and have not recently appeared. Only some 25 "blues" scattered among a large percentage of old blacks are new browns.[2] Bill and legs of a nutty brown indicative of youth and of one that seems to have on this first spring obtained half its "blues," and dropped them in March. Secondary quills not edged with greenish-blue, *e.g.* brown. Abdomen a greenish-white, and not so clear a white as in other birds, with tails of deeper blue. Tail feathers are in two stages; one moulting.

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1 The nest of this brood was placed in a bush only twelve (12) feet from the front door, and brought out four chicks (the only case we know of exceeding the usual number of three to a clutch). Unfortunately three succumbed to accidents.

2 The greys are displacing the blue-blacks along the dorsal region downwards.

Specimen 2.—Male (about 27 months old), 24/3/97. Browns are coming as well as have matured on the head, nape, cheeks and mantle. One large "blue" left in region of nape: no new "blues" on head or cheeks, but with some old ones remaining. Outer webs of secondary quills without any trace of greenish-blue; merely brown. Bill and feet jet black.

Specimen 3.—Male (approx. 2—3 years of age), 24/3/97. This skin is uniformly cloaked with the winter brown and with one "blue" on each cheek remaining. The brown feathers are well developed, new, or still coming, and in the lumbar region very long, as if prepared to resist the elements in a wet forest. Wing quills in process of moulting, and about midway in development. The spurious wings are maturing. Outer webs of wings have no trace of blue on them. Tail feathers in two stages; one set a quarter way on to maturity. Bill, black.

Specimen 4.—Adult male, nearly adult (approx. 3 years), 23/3/99. In accordance with the intensity of the purplish blue-black of the throat and chest feathers, the dense black of the line beneath the throat and around the neck, as well as the fairly deep-blue of the tail, this is the skin of a bird not in youth. As it has not the secondary quills edged with greenish-blue it is not a thoroughly aged bird, and I venture, by comparison, to put it down as one three years' old.

The brown feathers have mostly come upon the crown, but some are ·75 and ·50 towards maturity, while no young blues show.

Forehead: Few blues appear to be seen among the greys.

Cheeks: Browns new and developing, and about equal to the old blues remaining.

Neck: Black collar distinct, young "browns" showing beneath.

Mantle: Approx. 50% of browns and blues. The "browns" look new, while more are maturing below.

Throat: Browns are and have lately matured here.

Wings: The sixth primary on each is half its normal length.

Abdominal region has the feathers creamy white, between youth and old age.

Tail: There is a new set breaking from its sheaths, and now peep beyond the upper coverts.

Bill, black.

The "winter browns" are coming all over the body, and excepting the doubtful feathers of the forehead the bird is a thorough moulter of its blues and blue-blacks.

Specimen 5.—Adult male, more than 3 years old, 20/4/98. This skin is apparently one of those that attain their nuptial plumage in autumn, as the back, neck and throat shew all the brown feathers to be old. About 75% of the blues of the body are now shown, and are new, while the remaining 25% are appearing to view beneath the plumage.

Cheeks: Blues coming and matured; no browns.

Forehead and crown: Blues in large quantity bursting into full feather; no browns.

Neck: Blacks are quite new, in different stages of growth.

Mantle: Blues in large quantity bursting into bloom.

Back: New blacks appearing; "browns," old.

Lower chest and abdominal feathers are fairly white.

Secondary quills have the margins of the outer webs washed with blue; (sign of old age.)

Specimen 6.—Adult male (approx. 3 years' old), 23/3/99. Of twenty skins in my cabinet that are in semi-liveried plumage this is the only one that presents a problem to us, for it is gaining new "blues" and "browns," and has some of the black-collar feathers crescently tipped with brown. As the blues and blacks predominate, it appears to me as a bird trying to attain its nuptial plumage in autumn as is customary with a small percentage.

Complement of "blues" are near 60% of spring plumage.

Forehead and crown show new "blues and browns."

Cheeks: New "blues and browns;" the blues in the majority.

Neck: Blacks coming in large numbers with two or three "browns."

Mantles: "Blues" seem old; browns are coming while some appear aged.

Throat and upper breast: Both "blue-blacks and greyish-whites" are new, the greys being in the minority.

Back: The black plumage is new.

Feathers of abdomen: Creamy white.

Secondary quills have not attained the bluish-green wash; fifth, sixth, and tenth wing quills not yet developed.

Tail : Deep-blue (new.)

The autumn plumage will be disfigured by "browns."

Specimen 7.—Adult male (approx. 3 years old), 24/8/97. Dorsal plumage brown with heavy outcrops of blue-black, and a few signs of coming "blues." Tail, deep-blue ; abdomen, a fairly clear white; and secondary quills without any greenish-blue. These three characters help to indicate the age. This bird has simply to throw off a mass of "brown," and it will appear in all its glory.

Specimen 8.—Adult male (more than 3 years' old), 27/8/96. It is much like the skin of 24/8/97. The outer webs of the secondary quills shew only a faint trace of blue on two of them. It is not so mature a bird as those of 20/4/97 and 24/8/97.

Specimen 9.—Adult male (more than 3 years old), 4/5/98.

Head : Only a few "browns" remain, and "blues" are still bursting, especially from the forehead.

Mantle: "Blues," about equal with the "browns," but these are maturing blues beneath the surface.

Throat: "Blue-blacks" have appeared; only four "browns" remain, and this is the first part to arrive at maturity.

Cheeks have nearly all their "blues."

Nape : The blacks are hidden by the browns, but beneath they are in evidence.

Secondary quills show their outer edges to be washed with faint blue; not so distinctly as in the skin of 24/8/97, but more so than in that of 27/8/96. Tips of quills tend to whiten; both autumn and spring quills in these fully matured birds show this.

Abdomen is clear white; flanks have many browns still to fall.

Tail : Deep blue.

This is the blue-wren so many of us see in the winter—the so-called scarce bird—as it comparatively is.

Specimen 10.—Adult male (more than 3 years' old), 20/4/97. Almost in full livery.

Forehead, crown, mantle and cheeks: Blues still coming; while two large brown feathers still remain as evidence of a former plainly dressed stage.

Throat : This region shews the last of the blue-blacks bursting in the season.

Secondary quills edged with greenish-blue, not as intense as that of 24/8/97, but on a par with that of 4/5/98.

Tail : Deep blue with some pure white tips.

Specimen 11.—Adult male (well-up in years), 24/8/27. Apparently in full nuptial plumage, crown of head and mantle; some few blues are still maturing and lie hidden. A pectoral dense black narrow line shews as a septum between the blue-black of the lower throat and the lower chest white. Abdomen and flanks are whiter than in the majority of specimens.

Secondary quills : The edges of the outer webs shew greenish-blue more prominently than in any of the other specimens examined. The tips are terminated with white.

Tail : Deep blue.

In a letter to me, dated 13th March of this year, Mr. Graham writes of capturing three fine specimens of male birds which showed tails having feathers of various lengths now coming, and new "quills" with shafts of grey shewing out amongst the old "blacks and blues." Unfortunately these turned into a decomposed state owing to the very hot weather, and were not preserved. This is apt to make one think the "blue birds" are not such rare autumn monitors of the "browns" as I have been partly influenced to believe by my deductions from the numbers of blues in the Heytesbury. I say the Heytesbury, because I have put great faith in Mr. Graham's keen and extensive observation.

The moults of the female bird are not so striking as those of the male, because the tail and lores are about the only colored parts that attract one's attention for purpose of recognition. The young females start the change of colour of bill, from nutty brown to black, in September, as well as the tail from brown to blue. Both these parts also change in April—May. The young of December would make very slight change before the spring, but it would be more definite in April and settled by the following spring. Considering the large number of female wrens relative to the small quantity of nests (keenly hunted for), it appears to me as likely the young female may pass the first year without breeding.

A. Female nestling, December brood : Lores, light; Chest, nutty brown; tail, brown.

B. Young female, 1/4/99. The skin shows advance of winter plumage.

The lores and anterior orbital feathers are reddish, as in adult female.

Bill: Usual chocolate color of female wrens. The tail quills are brown with a faint trace of blue, as those of a bird that is now making its second or third moult. Judging by tails examined, I should say the blue wren does not carry the original tail during the first year like many birds, but sheds it just before the first autumn in favor of a longer and stronger one. The Gallinæ drop the original quills before they are one-third grown. Above these, new feathers are half-way along the tail and colored a light blue distinct from the others, and not nearly so blue as the next and older stage. Dorsal plumage greyish-brown, lighter than C.

C. Adult female, August. Tail: Deep blue. Dorsal surface ruddy brown and darker than in B.

In examining six skins of *M. cyaneus*, I find one is actively moulting its "blues" and receiving "browns" on Jan. 26. The remaining five simply show the "blues" coming in spring time, but they all (except one) shew unmistakable evidences that they are not receiving "blues" for the first time. They are simply parallel cases to those of *M. gouldii*, but instead of my obtaining them in late summer I have collected in late winter.

Specimen 1.—Male, 26/1/98. Approx. ·20 of the "blues" on the mantle and ·50 on the head. No new "blues" or "blue-blacks" appearing. Crown and nape show new "browns" coming, and new "browns" almost matured; few blues remaining.

Mantle: New and almost fully matured browns.

Back shows new "browns."

Throat: All the new feathers are greyish-white, many showing above the "blue-blacks."

Tail: A new set of deeper blue feathers are ·75 developed; the others still remain.

Bill: Brownish-black; between 1—3 years. This seems to me an early moult, but as the summer of 1898 was early, and the hottest for thirty years past, the bird may thus have been the recipient of an early moult.

Specimen 2.—Young male, about 9 months' old, 4/8/94.

Bill, lores, legs and feet chestnutty brown.

Tail: Blue.

This is evidently a bird from the last season's nest.

Specimen 3.—Adult male, 31/7/96.

Lores black of adult and not brown of youth or winter plumage.

Bill: Black.

Tail: Feathers blue.

Upper surface brown, under surface whitish. Although, adult, this is not an aged bird.

Specimen 4.—Adult male, 11/9/97.

Lores: Brown, with one or two blacks peeping through.

Blues and blue-blacks generally coming.

Tail: New feathers deep blue.

Specimen 5.—Adult male, 16/7/96. Bill, black; tail, deep blue. "Blues" nearly fully arrived to form mantle.

Specimen 6.—Adult male, 17/7/96. Approaching full nuptial plumage, with many new "blues and blue-blacks" developing. The tail is so deeply blue and the lower chest so clear white that I have no doubt it is more than two years' old.

Other male birds of this species I find to be approaching "full livery," are dated—

a' - -	17/7/96.
a'' - -	9/8/94.
a''' - -	16/10/97.

The moult for the year in others was completely finished in—

b' - -	18/8/94.
b'' - -	25/9/97.
b''' - -	16/10/97.

C. *Male Wren under Domestication.*

To try and rear wrens in ordinary aviaries means a chapter of accidents. Even in the exact haunt of the birds Mr. Graham had trouble, for he writes: "After many fruitless attempts to rear the young birds I decided to let the old ones do the rearing. To this purpose I made four large cages, and installed a nest of young birds in each. This answered very well, for, food being abundant, the young were kept well supplied through the wire of the cages, until a succession of cold nights ended the experiment by killing the young birds to the last one." They needed the warmth and break-wind of the parent.

On 12/7/98 Mr. Graham caged a wild bird. "No change was observable in its condition until 13th October, when a small speck of blue appeared below the left cheek. On 25th October I noticed new blue feathers under old greys. I took the bird in my hands and found a few blacks and blues sprouting beneath greys. On 11th November new tail feathers pushed out. Two upper tail feathers fell out on the 14th. On 25th new blues appeared budding on head and around upper mandible; bill growing darker in colour. Black or sombre colour on cheeks have taken the place of rufous. By 6th January the two upper tail feathers seemed to have attained full length. On 20th January some wing feathers fell out; nothing further of note until 28th February, when several tail feathers fell out; breast greys began to fall and moulting seemed rapid. New browns are "bursting:" Two more tail feathers fell out on 18th March. From 20th to 26th March several wing feathers fell, and all trace of blues disappeared from above bill and around head. Last two old tail feathers fell out on 28th March while two new ones were coming in their place; few body feathers still falling. Few greys and blues still falling on 2nd April. At the present time (3rd April) it has all the appearance of old males in the bush, *e.g.*, grey body, blue tail, and a bill gradually getting blacker. Although it did not get properly through its most important moult (spring), and attain a full livery, it came out true to the autumn moult. Its failing to develope a full crop of blues and blacks and to discard its winter plumage at the proper time (November, or earlier) was due, perhaps, to want of proper food, variety in diet, unfavourable conditions as to sunlight and exercise, or something we do not know of.

"As to food supplied—quantity, preference, etc., from July to 1st January, grubs,[1] with a little finely chopped meat, bread-crumbs, small beetles and caterpillars, formed the bulk of its food. It generally managed to dispose of sixty grubs, about a dozen small insects, and a small portion of bread and meat, sufficient to equal the bulk of 100 grubs, as named above, per day. From 1st January to 1st April, grasshoppers have formed the staple, varied with March-flies and cockroaches. The quantity devoured amount to about the same as with the

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1 Mr. C. French, F.L.S., has kindly identified these for me as the larvæ of a species of Anoplognathus.

grubs, viz., 100 per day, and the immature form of the great green grasshopper is preferred to all other kinds of food I have given to it. Moths, March-flies and small winged insects are greedily devoured; in fact it can 'stow away' four large blow-flies on a fairly full stomach."

I have not been able to go so thoroughly into the subject as would have brought out more facts in this essay as well as have taken from it some week points; but having ascertained the facts enquired for and of most importance, I now use the opportunity of the close to a season to record the above notes on the natural history of the Maluri.

ART. VI.—*The Bone Clay and Associated Basalts at the Great Buninyong Estate Mine.*

BY T. S. HART, M.A.

[Read 8th June, 1899.]

In the latter part of 1897 certain fossil bones were discovered at the Great Buninyong Estate Mine, a number of which came into my hands through the Hon. R. T. Vale, Chairman of Directors. Others I collected myself. The bones have been submitted to Mr. C. W. De Vis, of the Queensland Museum, whose notes on them are now presented with this. One of those obtained by Mr. Vale showed evidence of human action in shaping it. This bone and others have already been exhibited to the Society.

It remains for me to describe the occurrence of these remains, and to offer some observations on the district.

The locality has been geologically mapped and described by Mr. R. A. F. Murray.[1] I shall have later to refer to certain differences in the lava streams and boundary lines between them not indicated by him.

The Mine.—The mine is situated about $1\frac{1}{2}$ miles south of Buninyong railway station, and was intended to work the supposed continuation of the Devonshire and Union Jack leads, which had been worked some years ago. The workings had stopped from the No. 8 shaft soon after the date of Mr. Murray's report on the district, in which report the workings of the mine were described.

The lead is now covered by basalt, of which there are said to be two flows. The No. 1 shaft of the present company was sunk near the east edge of this basalt, but passed through a thickness of 143ft., in which there are said to have been two flows recognised, but the present manager, who took charge at 89ft. from the surface, says that the junction, if there are two flows, is above that point. From 143ft. onward the shaft con-

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1 Geological Survey of Victoria, Progress Report No. 1.

tinued in the Ordovician bed rock. An upper level at 200ft. passed into a stratified black clay with much carbonaceous matter. The lower level at 320ft. passed at a distance of about 360ft. from the shaft into a tumultuous mass of volcanic ejectamenta, containing large blocks of basalt and a smaller quantity of blocks of the bed rock. The deposit is quite unstratified in this level. The largest block is said to have measured 20ft. in length. The contact with the bed rock on both sides of this deposit is inclined inwards and blocks of the bed rock are commoner near the north-west contact. From this level a rise was made which passed into the black clay at 238ft. below the surface, and was connected by a drive on an incline to the upper level. At the top of this rise the first bones were found, viz., part of the head and lower end of the left humerus of Macropus faunus, as explained in Mr. De Vis' notes. The remainder of the bones were found in the connecting drive, which was driven from the rise towards the upper level. All the bones as found contained much pyrites, as did also the black clay in which they were found. This was more evident before treating them with size to preserve them. Parts of the hind limbs of two individuals and a skull of one were taken out by myself from the sides of this drive.

The clay beds dipped irregularly at low angles for the most part, and at the junction with the bed rock dipped from the line of contact. There were numerous surfaces of motion in the clay, and nearly all the longer bones were much fractured when first found in the clay, but usually with the pieces in their proper relative positions—showing that the fracturing was due to causes affecting them after burial.

A similar deposit was struck in another rise from the lower level. An intermediate level from this rise was driven north-easterly to a distance of 620ft. in a direct line at a depth of 295ft., or 25ft. above the bottom level. This for the greater part of its length showed interstratified sedimentary and volcanic materials, with blocks which had evidently fallen on the soft beds, disorganising the coarser ones and fracturing or bending the finer ones. No recognisable organic remains

were found here. A similar deposit may have existed in the other earlier rise between the ejectamenta and the black clays, being concealed behind the timber.

The beds in this 295ft. level were somewhat undulating, but not so disturbed as in the upper level.

At the end of this level, after passing out of the volcanic material, a rise revealed the presence of a similar material, with the line of contact dipping northerly, as if to a second hollow.

From the bottom level a small gutter was found and worked till it stopped abruptly against the volcanic ejectamenta, close to the boundary of the same material in the bottom level and at a height of 55ft. above it. I did not see this, as work was immediately stopped and the ventilating pipes withdrawn, the mine being closed in a few days. The volcanic ejectamenta then occupy a hollow in the bed rock 390ft. in one direction. They are overlain by mixed volcanic and sedimentary material, the volcanic materials becoming very much less in upper levels and the ejected blocks ceasing altogether. The whole range in height proved is from less than 200ft. below the surface to below 320ft., *i.e.*, over 130 feet.

The second deposit of volcanic ejectamenta at the end of the intermediate level seems to be the same as met with in the old No. 8 workings, and described by Mr. Murray. The two may be connected with one another, though separated as seen in the drive.

Mr. Murray suggests that the deposit at the No. 8 is a volcanic outlet pipe. In that case a dyke of basalt was also found.

Such an explanation would account for the abrupt termination of the wash against the side of the volcanic materials in this mine. There is no evidence, however, of great heat in this case, and the materials resemble an ordinary subaerial accumulation of volcanic ejectamenta. The large size of the blocks would indicate proximity to the vent, and the actual vent may be in the immediate vicinity, though not exposed in the workings. The presence of ejected blocks in little disturbed beds above would require subsequent activity of another vent.

Another possible explanation is that the abrupt conclusion of the wash is due to subsequent movement and a lowering of the volcanic materials bodily. The slight disturbance of the clay and ash beds in the intermediate level, and the greater disturbance and apparent drag at the boundary of the Ordovician, would favour this, though the superincumbent weight of basalt might account for much movement and compression of the underlying soft material. The occurrence at the No. 8 workings of a lead dipping both ways also indicates changes of relative levels. If that lead falls north naturally to the Devonshire lead, it would indicate a subsidence to the south.

The abrupt conclusion of the wash and the position of the ejectamenta are then referable either to an actual vent, and succession of vents, or to local subsidences in the neighbourhood of a volcanic vent.

The depth of the bottom level does not preclude the possibility of a valley with an outlet to the Yarrowee lead existing below it, even apart from any movement. The surface level is here 1337ft. above sea level, and the bottom level 1017ft. At the No. 3 shaft of the old company the surface level is 1227ft. and the main gutter 280ft. below, or 947ft. above sea level.

Surface Materials.—The surface directly over the mine, is a basalt strip, which extends from Buninyong southward and slightly westward, to the south-west corner of the Buninyong Estate. It is bounded on the east, through the Buninyong Estate, by the Devonshire Creek, which nowhere crosses it on the surface. The surface of the basalt is somewhat uneven, but has a general and considerable fall of almost 100ft. to the mile southward. East of the creek the surface is for the most part Ordovician, more or loss covered by recent alluvium, but to the south-east of the No. 1 shaft is a hill marked by Mr. Murray as a point of eruption and known as Webb's Hill. From it two spurs run to the north-west and west, covered by volcanic ejectamenta, in which blocks of the Ordovician bed rock, usually micaceous, predominate on the north-west spur. On the other is an outcrop of vesicular lava, perhaps a dyke. There is no visible olivine present in any of the vesicular lavas and scoria on this hill, which is in striking contrast to the

Buninyong basalt stream and to that on Mount Buninyong itself, in which olivine is extremely common, particularly in vesicular materials.

Webb's Hill and these two ridges would seem to represent the remnants of an old volcano. The extension of the volcanic material to the west would naturally be expected to occur under the Buninyong basalt, and the volcanic ejectamenta there found with these surface materials, perhaps represent successive eruptions from different vents. The present disposition of the surface volcanic material would favour a vent nearer Webb's Hill, or between it and the No. 1 shaft.

At the south-west corner of the Buninyong Estate the lava streams are easily distinguishable into three, differing in appearance, usually in a very marked degree.

In the bed of the Yarrowee Creek is a dark, compact lava, with much porphyritic augite and little olivine visible, which agrees with Messrs. Murray and Etheridge's description of what they name the Durham Lead flows[1]. It appears to be their Upper Durham Lead flow. It is seen higher up at Scotchman's Creek, but further I have not investigated its continuation. It extends down the Durham Lead below. Similar basalt occurs in the blocks in the ash on the north spur from Webb's Hill and in the ejectamenta of the No. 1 workings.

Overlying this on both sides of the Yarrowee Creek is a paler and coarser textured lava, without any visible olivine or porphyritic minerals, and similar to that which occurs on the western volcanic area of Ballarat—subsequently referred to as the Yarrowee lava. This appears to be close to its southern end, and not extending much further. The Buninyong lava stream is characterised by the extreme abundance of olivine, often in large lumps of 2in. or more diameter in the vesicular portions. This character is found invariably from the township across Buninyong Estate to a low bank running parallel to the Yarrowee at the west side of the Buninyong Estate and another low bank near the mouth of the Devonshire Creek, both marked on Mr. Murray's map. Between these it reaches the Yarrowee for a short distance, but never crosses it.

1 Geological Survey of Victoria, Progress Report No. 2.

Beyond both these banks the Yarrowee type is found, and also on the other side of the Devonshire Creek, at its mouth. The actual contact is nowhere seen, being always concealed by soil, but blocks *in situ* on the Devonshire Creek west bank above No. 3 shaft are, though decomposed, most like the Yarrowee type. At the No. 3 shaft the Durham Lead type is most common, but the accessible surface excavations are in the Buninyong basalt. The Yarrowee type also occurs here, probably from the shaft.

It is easily seen that the Yarrowee flow overlies the Durham Lead flow, and the disposition and amount of denudation of the two makes it certain that the Buninyong overlies the Yarrowee flow, independently of the somewhat doubtful superposition in the Devonshire Creek. The lava flows from Buninyong would, therefore, be the newest, and from the amount of erosion which they have undergone, need not be of any great age.

The height of the basaltic plain above the creek varies, but only at two places does it exceed that close to the No. 1 shaft, viz., about 30ft. These are at a short distance before its junction with the Yarrowee Creek and at a point at the south boundary of the township, where the Devonshire Creek, coming from the ranges to the east, first meets it, and is deflected southward. There is nothing to indicate that any appreciable portion of the basalt has been removed by denudation—indeed, near the No. 1 shaft and near the mouth of the creek this could not have been so. At the Devonshire shaft east of the creek, near the No. 8 shaft, 40ft. of basalt was passed through, under 70ft. of drift and clay. If this is from Buninyong, it is not the present surface basalt.

The area in which the bones occur would almost necessarily be a lake or swamp, with the present relative levels, as the bottom of the basalt is about 1195ft. above sea level, and this is very little above the present level of the Yarrowee Creek, whose course can only have been very slightly affected by the Buninyong basalt, and must have been higher than at present.

On the other hand a very considerable time probably elapsed between Yarrowee and Buninyong flows, and also very likely between the Durham Lead and Yarrowee flows.

It would also be evident that the period of activity of Webb's Hill is much older than that of the Buninyong lava stream here dealt with. The erosion previous to that flow of lava was probably considerable, and now the materials on the surface would appear for the most part to represent the older ejectamenta of that hill. From the period of activity and similarity of lava it may be that Webb's Hill and the vents now buried are contemporaneous, and perhaps connected with the Durham Lead lava, for which Messrs. Murray and Etheridge suggest a source near Buninyong.

We have, then, that there is represented in the locality an earlier period of volcanic activity to which we may refer Webb's Hill, the ejectamenta in the mines, and the Durham Lead and Yarrowee flows. The black clay beds accumulated subsequently to these in a swamp or lake until covered by lava streams from Buninyong. There need not have been any considerable lapse of time since this, so that the bones are referable to a comparatively recent period.

In conclusion, I must express my thanks to the Hon. R. T. Vale and Mr. N. Kent, the mine manager, for the assistance and facilities given in examining the mine and collecting fossils, and also for plans of the workings; to Mr. De Vis, for the valuable discussion of the authenticity and identification of the bones; and to Mr. R. J. Allen, engineering assistant at the Ballarat School of Mines, who undertook certain surveys and levels; and to those who have at various times assisted me in the collection of fossils, and in other ways.

ART. VII.—*Remarks on a Fossil Implement and Bones of an Extinct Kangaroo.*

BY C. W. DE VIS, M.A.

(With Plate VII.).

[Read 8th June, 1899.]

All who have given intelligent thought to the history of Australia in the past, onward from the time of her greatest amplitude of animal life, have doubtless marvelled to find that of antique man no traces, such as are frequent in most other regions of the earth, have been discovered on or beneath her surface. In search of her material wealth that surface has been explored over a great part of its extent and proved to all reasonable depths, yet not a bone, not a handiwork of the most imperishable nature, to which a geological or even archæological interest can really attach, has been brought to light. We have nothing to clearly demonstrate man's existence in the land while its superficial features were in course of modification, nothing to suggest that the legendary lore of the Aborigine may be something more than the spontaneous creation of savages without a local history. Had such relics been extant we should almost necessarily have read in them, so far as we could read aught in them, the history of the forefathers of the so called Aborigines. The want of them has had this consequence, that the Australian "Negroid" has been pretty generally assumed to be a forlorn alien—an involuntary immigrant into unoccupied territory in comparatively recent times, and in the asserted absence of signs of kinship with nearer neighbours, has been pronounced by authority, more or less reliable, to be genetically related to various distant races, notably to the Dravidian Hill Tribes of India. Perhaps it is not too venturesome to hint that speculation of the kind has led to no satisfactory conclusion; the coincidences of word and grammar, and even of skull-characters, have not carried conviction to the mind—that in point of fact the derivation

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of the native race is as much a mystery to us as ever. So far as we positively know, it is quite as likely that it was contemporary, in a general sense, with the Cave Men of Europe as that it resulted from a migratory wave of much later date, which threw it ashore under conceivable, but not very probable, circumstances. Balanced in this uncertainty we have not ceased to cherish the hope that a fortunate accident would at length remove it by uncovering some sign of an older stratum of humanity beneath our feet, and by the same token held ourselves prepared to scrutinize with as much impartiality as caution any claim in its behalf made upon our judgment. In presence of a fossil which has been most kindly entrusted to the writer by its first inquisitors, the Hon. R. T. Vale, M.P., chairman of the Local Board of the Buninyong Mining Company, Ballarat, and Mr. T. S. Hart, M.A., of the Ballarat School of Mines, it would now really seem to him that such evidence is forthcoming, notwithstanding the antecedent improbability established in his mind by failure to find a trace of man heretofore among relics of ancient life. At first sight the fossil appears to have been intentionally shaped to adapt it to some instrumental use. It may, then, be convenient to confirm this first impression by pointing out the marks of human workmanship which it has, with more loss certainty, preserved to us. It consists of part of the distal half of a right rib, the seventh or eighth, of an animal so large that it could only have been one of the greater Nototheres, in all probability *Nototherium mitchelli*, Owen. It is perfectly mineralized in the usual manner, differing in no wise in texture and colour from well preserved contemporary fossils found elsewhere. Fortunately it is accompanied by a portion of the head of the same rib; in conjunction with which it corresponds in all essential features with a rib of *Nototherium mitchelli* among Queensland remains of that species. The length of the fragment is 154 mm.; by the loss of its central edge, which has been split off, its greatest breadth has been reduced to 42 mm. On its posterior aspect (Fig. 1), there is at (*a*) an obvious flattening of the upper part of the blade, the surface of the bone for a length of 65 mm. having been removed to an appreciable depth, and apparently by some mode of abrasion; near the distal end of the split edge on

the same side appears a marked hollow (*b*), at the bottom of which the cancellous structure of the interior of the shaft has been by the like means brought into view.

So far the abnormal features observable are not of intrinsic importance. They may have been the result of ordinary physical agencies of attrition. A similar explanation of the condition of the lower end of the bone, or at least of one edge of it, is, on the contrary, inadmissible. On its posterior face (Fig. 2) the rib has here been half sundered by a cut through its dense cortex (*c*), effected by strokes of a sharp instrument. A little lower down on its opposite face (Figs. 1 and 2*d*), it has been divided to a like extent, and the part beyond the two nicks so made has broken off, the line of fracture naturally occurring between them. The extreme edge of the fracture was thus brought to coincide with the inner edge of the lower nick, and this consequently presents a fairly sharp edge, rendered somewhat jagged by adherent remains of the internal cancelli. The surface of the lower nick (Fig. 1*d*) is convex in both its directions of extent, but whether this rounding off is the result of an original method of formation by filing, scraping, or shearing tool, or by the subsequent grinding of a surface in whatever way produced, is not to be gathered from the existing surface. In the latter case it is of course quite possible that this bevelled surface also might have been the outcome of mere physical action on a piece of rib lying in a watercourse or sand-drift, with one end partially exposed; it is even possible that the severance of the bone on this side of it was due to such cause. But these conjectures seem to be entirely forbidden by the complete absence of any sign of abrasion on the inner side of the edge of the nick; the broken walls of the bone cells, even at its extreme edge, are as sharp and prominent as they were left by their fracture, and we are therefore driven to the conclusion that this surface, however formed, was intentionally formed. That the surface of the upper nick—that on the opposite side of the bone (Fig. 2*c*)—could not have been yielded by any physical process, is on the other hand unquestionable. It is certainly the work of an animal possessed of a chopping instrument, and as far as we know the only animal of the age of the Nototherium that can excite even a passing suspicion is the so-called Marsupial Lion, *Thylacoleo*

carnifex, Owen, a confirmed bone-eater, with enormous shearing teeth. With the ossifragous capability of Thylacoleo we are not at this day unfamiliar, and experience makes it quite safe to say that the bone was not cut by the molars of that animal.

Powerful as its jaws undoubtedly were, they have left no evidence that they were able to cut through dense bone to any considerable depth, certainly not to the depth of 3 mm., as in the case before us. They chopped the surface (generally on opposite sides) but slightly, to a depth of a millimeter or so at the most; and by the impact of the blow or by continued effort crushed the bone in twain. The form of the incision is in itself sufficient proof that it was not the work of Thylacoleo. Its outer or upper edge, crossing the rib obliquely, is irregularly undulating, its surface inclined from without inward at an open angle, shows, under a certain incidence of light, three shallow, unequal undulations, or rather subconchoidal depressions which could only have been sculptured by an instrument having a strong bevel above its cutting edge. The surface of wear of the molars of Thylacoleo, which so frequently leaves its impression on the substance of long bones subjected to their action, is level, except that occasionally it is more or less distinctly bevelled off at its posterior end; the cut effected by it across the shaft of a bone is therefore a straight-edged and flat-surfaced notch. Of producing one with an edge which is even slightly scalloped and with a broad oblique surface of conchoidal facets, it is altogether incapable. We have, therefore, to fall back on an unknown user of an instrument adequate to the purpose, and this could not well have been any other than man. If now we are prepared to accept the view that this bone was wrought by human hands, and for the nonce assume the genuineness of the fossil, we shall have little difficulty in understanding how and why it received its shape. We may infer that the upper nick was first made; afterwards, and probably with the same instrument—a small, sharp stone tomahawk—the lower nick; the bone then broken between them, and the lower end ground with a bevel in order to obtain an edge which should be curved, moderately sharp, and rather rugose. Such would be an edge suitable for a scraper for the removal of flesh and fat from the inner side of skins and rendering the cleansed skins supple for use. Holding

the bone in position for this purpose, the tip of the middle finger falls into the hollow (Fig. 1*b*) and the base of the index on the flattened area (Fig. 1*a*); it is therefore not altogether unlikely that these abrasions of its surface are evidence of laborious usage if they were not superinduced on depressions purposely made in aid of the grasp. While the head of the rib remained attached to the working part of the shaft, the whole implement had a length sufficient for the employment of both hands, and effectiveness proportionate to the leverage obtained and power applied.

But though it may be thought beyond cavil that this bone has been purposely shaped, a question quite as important remains for settlement. When did it take its present form—as a green bone, or as a fossil? In other words, is it genuiné or fictitious? Doubt as to the validity of its pretensions rose strongly and persisted obstinately in the mind of the writer when he found that from a similar piece of Nototherium rib he could with a pen-knife carve a very fair imitation of the fossil. But scepticism has succumbed to the explanation and assurances he has received during a lengthened correspondence with Mr. Hart and Mr. Vale, fortified by a statutory declaration of Mr. N. Kent, manager of the mine, to the effect that he received from the workmen the fossil covered with dirt, with a number of others in the same investment, and handed it in that condition to Mr. Vale. It is, of course, to be said that Mr. Kent's declaration does not go to the root of the matter. It does not disavouch the possibility that one of those who exhumed these bones and delivered them to Mr. Kent, had the opportunity, will, and ability to fabricate the one in question. We may, however, be content to set against this defect the unlikelihood that among the Ballarat miners there was one so far acquainted with ethnology as to know how to convert with so much skill a piece of bone into a scraper, or be led to do so by a knowledge of the interest that would attach to it; or, having done so, neglected to identify himself and his interests with the spurious discovery. He must have been a remarkably clever forger who, under the circumstances, made the chief nick exactly as it would be left by a stone tomahawk and not with a continuous surface; and who, moreover, carefully coloured that surface to disguise its rawness. How different its colour is to that of a fresh incision was ascer

tained by Mr. Vale, and is confirmed by a slight cut near the end of the bone, made by the writer. On the whole, then, it appears that although there are reasonable *a priori* grounds for suspecting that the rib was surreptitiously carved before it reached Mr. Kent's hands, yet the reasons against believing that it was actually so tampered with are insuperable. If, then, the bone received its present shape from the hand of man, and before it was buried to 238ft. below the ground, we cannot decline to see in it an implement fashioned out of a bone of a now extinct animal by a man to whom the living animal was familiar, since after fossilisation and the brittleness induced thereby, the formation of its chopped surfaces by a savage was simply impossible.

In an object which is believed to be the first to record the presence and indicate the condition of man in Australia in an age so remote, we cannot but feel a profound interest. It is at length permissible for us to imagine him to have been in conflict with the great Marsupials, fearsome reptiles, and other enormities of the prolific Nototherian age, and in his generation to have witnessed the vast physical changes which time has wrought upon his dwelling-place—changes on the whole so inimical to animal life that he was left with scarce a tithe of his former means of subsistence.

Permissible also is it for us to hope that this record is an earnest of further discovery of the kind.

The proof of its stratigraphical association with the other bones mentioned by Mr. Kent, although without bearing on the question of its genuiness as an implement, may by the way be stated. It is supplied by a peculiar phase of mineralisation common to all of them in the form of a secondary impregnation with a cementation by iron pyrites to quite an unusual extent. Mr. Vale, in one of his letters, remarks that this impregnation was much more evident in the fossil implement when first examined by him than it became after much handling; at present one fails to detect it.

The bones found with the implement are one and all derived from a species of Kangaroo. They have a special interest of their own, because the occurrence of even so many bones of the same skeleton together being unique, it affords most welcome guides to the identification of Macropodine bones scattered

through our collections. They consist of the greater part of a cranium, the symphysial region and part of the horizontal ramus of a lower jaw, portions of three vertebræ of a sacrum, pelvis, humerus, two femurs, tibia, and fibula, together with an almost entire foot. Although the proportions of some of these parts one with another are considerably different from those of their counterparts in existing Macropods, and caution us emphatically against placing unreserved reliance on the accuracy of any reference of an isolated bone with this or that species of extinct kangaroo, they do not exceed in difference what may fairly be attributed to adaptive modification, and are therefore not inconsistent with the belief that all of them belonged to a single skeleton. They are referable to a species named by the writer *Macropus faunus.*[1] The cranium in its present condition offers no distinctive characters worthy of note; any that may have existed originally have been effaced by a complete flattening and distortion of its component bones under incumbent pressure. The intermaxillaries, with their implanted teeth—with the exception of the left outermost incisor—have escaped material injury. The length of the third incisor equals the chord of the arc formed by the two taken together; this tooth is strongly notched at its anterior two-fifths. The cheek teeth of the same side—those of the right jaw having been destroyed—are all in place and intact; in structure they agree closely with those of the type of the species, but indicate by their greater degree of wear a more advanced period of age.

This notwithstanding, the premolar is still firmly in place, and shows no sign of speedy extrusion. The apparent permanence of this tooth makes it necessary to correct the impression conveyed by the words "procumbent on the verge of the diastema," in the account given of *M. faunus.* The writer was evidently misled in concluding from the overhanging position of the type premolar, that it had not long to remain in place. The persistent premolar and elongate notched third incisor associated with roundly lobed and strongly linked molars in *M. faunus*, are salutary admonishers of the fact that the dental differences shown by Macropus and Halmaturus in modern times,

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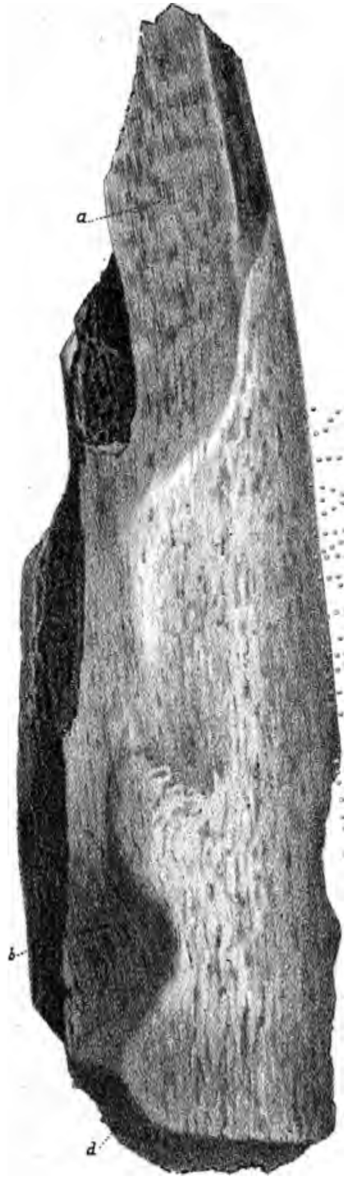
1 Pro. Lin. Soc. N.S.W., ser. 1, vol. x., p. 127.

were not invariably established in the earlier and more vigorous age of Macropod development. The palate, so far as can be gathered from its crushed remains, was nearly or quite entire. The remains of vertebræ and the fragment of the pelvis left to us, unfortunately, are too characterless to illustrate the axial skeleton, but in the appendicular bones there is much to interest us; more especially in those of the hind-quarters. Most of its members as the femur, tibia and fibula, would have been, and indeed have been, by virtue of their size, homologized with the teeth of the most gigantic of the Macropods, *Sthenurus goliah*, Clearly, the proportions of modern kangaroos form a very unsafe basis for specific osteology to work upon. The right femur is represented by the condylar end only. The remains of that of the left side include the head, the upper part of the shaft and the distal extremity. Placed alongside a complete bone, selected on account of its affording a fairly exact replica of the remains under examination, the latter indicate a total length of 375 mm. Apart from size, the most important difference between the femur of *M. faunus* and *M. giganteus* (259 mm. in length), is seen in the greater proportional depth of the inner condyle which is therefore much more nearly of the same size as the outer one. The effect of this would be to turn the animals toes outward, and thus enable it to take a broader base of support and more efficient grasp of the ground. The tibia, also of the left side, has also for its relics the head, part of the shaft and the lower articular extremity, the last cemented to the astragalus. Its head, in breadth, corresponding to the condyles of the femur, agrees in dimensions with that of a young bone in the Queensland collection, which, though it has lost its epiphysis, measures 700 mm. in length, and with its epipysis, would reach to 720 mm., a length which, other parts being proportionate, would indicate a bulk of carcass five or six times greater than that of an average example of the Great Kangaroo, *M. giganteus*. In contrast with this great development of the hinder parts, it is interesting to remember that the size of the head was comparatively small. On comparing the lengths of the lower series of cheek-teeth in the two animals, *M. faunus* would, on this base of calculation, appear to be not more than twice the size of *M. giganteus*. That its fore-quarters were disproportionately light, even for a kangaroo, appears further

in the shortness of the fore-limb. The humerus of the left side is in evidence. Of this bone we have the head, minus the lesser tuberosity, and the lower end of the shaft with a portion of the outer condyle and capitellum. The length of the head and greater tuberosity, 58 mm., bears about the same proportion to that of the cheek-teeth, as do the corresponding parts of *M. giganteus* one to another. On the testimony of this dimension the bulk of *M. faunus* might have been estimated as about two and a half times that of *M. giganteus*. A bone in the Queensland collection, so like this as to be referable to the same species, though previously attributed to *M. magister*, is 213 mm. in length, and 82 mm. in the breadth of its distal end. The remains of the fibula appear uninstructive; those of the foot on the contrary yield information of no little value; compared with the tibia it is shorter proportionately than that of *M. giganteus*, and, in this respect, stands intermediate between the Great Kangaroo of the plains and the Wallaroo, *M. robustus*, of the mountains. Though conforming to the Macropodine type of foot in the attenuation and syndactylism of its second and third toes, and the consequent slenderness of its metatarse, its free toes are usually broad, and in the form of their claws present a suggestive modification. The fourth ungual phalanx, in lowland kangaroos and wallabies, a long trilaleral pyramid with straight edges and sharp angles, is curved on both its superior and inferior profiles, even more so than in Tree-climbing Kangaroos, Denarolagus, and has also near its distal end a marked curve outward. The fifth ungual phalanx is still more distinctly unciform; in general shape it might be compared to a hawk's upper mandible, with a rounded culmen and sharp lateral edges, of which the outer is dilated at about its posterior third. Sheathed with horn, this claw would ably support its colleague in securing a firm foot-hold on whatever surface the animal was wont to move. Reviewing the unusual concentration of weight and propelling power in the hind-quarters of the Fawn Kangaroo (if we may be allowed to give it a trivial name), the consequent lowering of its centre of gravity, its broad base of support and tenacious grasp on the ground, it is not difficult to surmise what were the habitat and mode of life of the animal. Who that has seen the Rock Wallaby at home can doubt that its feet and whole economy are fitted to scale heights

inaccessible to its congeners and their four-footed foes; yet its foot and whole structure are not so well adapted to the search for safety and food among crags and precipices as those of our venerable acquaintance seem to have been. Its whole form evolved by and ministering to the needs of a mountaineer, rendered it a far more expert alpine climber than the living Wallaroo.

II



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R. Wendel. lith.

ART. VIII.—*On the Occurrence of Trachyte in Victoria.*

BY EVELYN G. HOGG, M.A.

[Read 8th June, 1899.]

The term "trachyte" appears to have been introduced by Haüy in 1822 to denote certain igneous rocks which present a rough aspect in hand specimens, but since then the application of the term has been much narrowed down and in the following paper it is employed to describe a small group of igneous rocks of intermediate basicity, in which the dominant felspar is the sanidine variety of orthoclase, and in which the ground-mass, usually holocrystalline, mainly consists of felspar microliths; one or more of the ferro-magnesian minerals—biotite, hornblende and augite—may occur, while apatite, magnetite and zircon are often present. In the normal trachyte free quartz is absent.

Trachyte is of rare occurrence, and, though usually found in rocks of fairly recent origin, is not confined to those rocks, as a fresh augite-bearing trachyte is noted as occurring in rocks of Lower Carboniferous age in the Garlton Hills, Haddingtonshire,[1] and a mica-trachyte of Permian age is reported from Copplestone, near Knowle Hill in Devonshire.[2]

Owing to the interest which attaches to this rock, a brief notice of its occurrence in Australia may not be out of place.

Trachyte is noted in Queensland as occurring at Gladstone, at the Glasshouse Mountains and in the Mackay district.[3] The author of this paper has had—through the kindness of Mr. A. G. Maitland, F.G.S., formerly of the Queensland Geological Survey, and now Government Geologist of Western Australia—the opportunity of studying specimens from the two last mentioned localities. The trachyte from Mount Coonowarin (Crookneck), in the Glasshouse Mountains, is very similar in structure to that

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1 Hatch. Trans. Roy. Soc. Edin. (1892), xxxvii., pp. 115-126.

2 Hatch. Geol. Mag. (1892), p. 250.

3 Jack and Etheridge. Geology and Palæontology of Queensland and New Guinea, pp. 546, 714, 715, and 739.

of the Macedon district in Victoria, to be afterwards described. An analysis of a specimen of trachyte from Gladstone is given by Professor Liversidge in his "Minerals of New South Wales," 1888, p. 229.

Trachyte was discovered in New South Wales in the Coonabarabran district in 1895.[1] This is stated to be the first trachyte found in that colony, but in a paper dealing with "The Cupriferous Tuffs of the passage beds between the Triassic Hawkesbury series and the Permo-carboniferous Coal-measures of New South Wales,"[2] Professor David records a "greyish-purple trachyte lava." No description of the rock is given, and it is possible that the writer was using the term "trachyte" in its older and looser sense. The Rev. J. Milne Curran, F.G.S., in a paper entitled "Microscopic Structure of some Australian Rocks,"[3] had also noted a trachytic lava from the junction of Rocky Bridge Creek and the Lachlan River in New South Wales prior to 1895. From his brief description of the rock it is not clear how he arrived at his determination of the character of the leading felspar. A trachytic tuff is reported from the Manning River.[4]

I have not traced the occurrence of trachyte either in South or Western Australia. At a meeting of the Royal Society of Tasmania, held on 11th April, 1899, a paper was read by Messrs. W. H. Twelvetrees, F.G.S., and W. F. Pettard, F.G.S., describing the occurrence of haüyne-trachyte among the igneous rocks of Port Cygnet and Oyster Cove, Tasmania.

The presence of sanidine in the igneous rocks of Victoria was first noted by Mr. J. Dennant, F.G.S. At the Adelaide meeting of the A.A.A.S., 1893, in a paper entitled "Notes on the Igneous Rocks of South-Western Victoria," he described a series of sanidine-bearing rocks occurring in the district. From the map attached to his paper, it may be seen that these rocks have a very considerable extension. His researches led him to conclude that they were not phonolites, but he does not appear to have recognised their character as trachytes, as in his map they are

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1 G. W. Card. Records of the Geol. Survey of New South Wales, vol. iv., part iii., 1895.
2 Proc. A.A.A.S., vol. i., Sydney, 1887, p. 286.
3 Proc. Roy. Soc. New South Wales, 1891, vol. xxv., pp. 220-221.
4 G. W. Card. Records of the Geol. Survey of New South Wales, vol. v. part i., 1896.

classed as "sanidine and olivine rocks." That among the rocks so named by Mr. Dennant trachyte occurs was pointed out by the present author in a paper on "The Glacial Beds of Toolleen, Coleraine and Wanda Dale," read at the Sydney meeting of the A.A.A.S.. 1898, and the boundaries of the trachyte area in the immediate vicinity of Coleraine are there given.

The object of the present paper is to briefly record the occurrence of trachyte at Macedon, Mount Diogenes (the Camel's Hump), Dryden's Mount (the Hanging Rock) and Brock's Monument, and to make a few observations concerning the trachyte of the Coleraine district. The igneous rocks of the Macedon area are classed in the Quarter Sheet Map No. 6 of the Geol. Survey as "Trap or Hypogene;" the notes attached recognise the variety of igneous rock there displayed but no definite determination of the different rocks and their boundaries is given. An account of the great variety of rock to be found in the Macedon Range may be gathered from Murray's "Geology and Physical Geography of Victoria," page 27.

The first specimen of trachyte which came into my hands was given to me in February, 1895, by Mr. Graham Officer, B.Sc. It was taken from a small quarry near the waterfall on Turritable Creek, to the south-west of the township of Macedon. I visited the Macedon district in September, 1897, and on subsequent occasions, and collected specimens of trachyte between the township and Mount Diogenes, at Mount Diogenes and at Dryden's Mount. My specimens from Brock's Monument I owe to the kindness of Mr. A. E. Kitson, F.G.S., of the Mines Department.

Township of Macedon.—Two types of trachyte occur in the township. The first one to be described may be traced at intervals from the quarry previously mentioned to the summit of Mount Diogenes. It appears probable that the spur on which the township is built may consist entirely of trachyte of this type. In appearance it is a light coloured rock, of granular texture, and contains numerous pink and flesh-coloured crystals of felspar. Under the microscope the base is seen to resolve itself into a mass of felspar microliths, showing marked flow structure, and minute grains of mica and some opaque material which may be mica presenting the phenomenon of absorption. Neither hornblende nor augite can be definitely traced in the

ground mass. The felspar microliths are frequently twinned according to the Carlsbad law, give straight extinction and have very often the rude transverse parting so characteristic of sanidine. Large pellucid phenocrysts of felspar occur, mostly of tabular habit and showing rectangular cleavage lines. As a rule, the crystal boundaries are well marked, though occasionally, when bunches of crystals occur, one or more of the terminal faces may be wanting. In certain of the crystals small irregularly-shaped inclusions, either opaque or of deep brown colour, may be seen. This alteration product appears to start along cracks in the crystal, and is probably caused by the infiltration of iron oxide. The phenocrysts are on the whole very free from included matter; in some the phenomenon of strain-shadows is exhibited. The few crystals of columnar habit which appear in the slide show Carlsbad twinning, with occasionally the broken divisional line due to interpenetration. I have been unable with the means at my disposal to make a suitable measurement of the axial angle of the felspar, so as to at once settle whether it is sanidine or orthoclase, but after comparing it with the sanidine of trachyte from the Drachenfels, Monte di Vetta, Scarrupata and Laach, and of phonolites from many districts, and noting how many of the peculiar characteristics of sanidine it possesses, I see no reason to doubt that the monoclinic felspar of the Macedon rock is sanidine, and that the rock itself must be classed as a trachyte. The other minerals which occur in the rock, magnetite and sphene, do not call for any special notice.

The second type of trachyte which is found in this area differs slightly, both macroscopically and microscopically from that just described. It outcrops on the Turritable Creek near the residence of Mr. R. Harper and may be traced for some short distance up the creek. What exact field relation it bears to the trachyte already described and the igneous rock which constitutes the main rock-mass at the western end of the Macedon Range, I am unable at present to say. It is grey-brown in colour, fine-grained in texture, and shows numerous porphyritic crystals of glassy felspar. Under the microscope the ground mass appears to be made up of felspar microliths, grains of augite, and brown and opaque specks of matter. The felspar microliths are not so perfectly formed as in the rock just

described; they show a tendency to fray out; there are some signs of flow structure. The felspar phenocrysts are sanidine, for the most part idiomorphic: inclusions of apatite and opaque matter are numerous. Small crystals of augite occur with eroded edges; apatite is present in well formed crystals, and there are traces of mica and epidote.

Mount Diogenes (Camel's Hump)—the highest point of the range—is a dome-shaped boss, rising to an altitude of 3500 feet above sea-level. The main mass is composed of a rock very similar in outward appearance to the one first described from Turritable Creek. Under the microscope it is seen that the resemblance extends to the internal structure as well. There is the same fluxion arrangement of felspar microliths around well marked sanidine crystals. Zircon and mica are sparingly developed, and there is some chlorite—probably pseudomorph after hornblende. Between the summit of Mount Diogenes and the augite-felspar rock which forms the western extremity of the range, there is a small outcrop of a rather porous rock showing glassy felspar crystals. The base is an irregular mass of grains and ill-formed crystals of felspar; there is no trace of flow structure. The felspar phenocrysts appear to be sanidine, but they have undergone some alteration; hornblende, zircon, and needles and crystals of apatite are visible in the slide. The rock is an altered trachyte; it has some affinity to the second specimen from Turritable Creek, and may afford a clue to the relation of the trachyte to the other igneous rocks of this part of the range.

Dryden's Mount.—This is the most northerly point of the "trap" area at which I have found trachyte. Dryden's Mount —better known as the Hanging Rock—rises abruptly from the Woodend plateau. It shows a rude columnar structure in places and its shape suggests the remnant of the pipe or neck of an eroded volcano. It is so much weathered that it was a matter of some difficulty to get fresh specimens. The rock has a light-coloured matrix containing black specks and crystals of glassy felspar. The base is mainly composed of grains and minute crystals of felspar having straight extinction and showing only slight flow structure. As in the slides previously described, the base contains numerous specks of mica and opaque material.

The porphyritic felspar appears to be normal sanidine; it contains numerous inclusions, the most common being needles of apatite. Brown hornblende also occurs in phenocrysts, and there are a few crystals of apatite.

Brock's Monument.—I have not visited this locality, but from the Quarter-sheet map it would appear that the igneous rock at this place is intrusive through the Silurian rocks. It is the most easterly point of the Macedon district at which I have found trachyte. In appearance it is a blue-gray compact rock, studded with porphyritic crystals of felspar. Microscopically it bears a strong resemblance to the rock described from Dryden's Mount, the chief point of difference being the presence of augite in addition to hornblende—which latter mineral is much altered—and the relative scarcity of apatite. If the one rock is a trachyte so also is the other.

On the whole it will be seen that trachyte, where it occurs in the Macedon area, is fairly constant both in structure and composition. Glass and free quartz, if present at all, are there in only very minute quantities. Of the geological age of the igneous rocks above described very little is known. They are almost certainly post-Silurian, and from their apparent absence from the boulder-clay so largely developed further north, it seems probable that they were erupted subsequent to the Permo-carboniferous glacial age.

Coleraine District.—Under this title are comprised various localities near Coleraine, for the most part identical with those classed by Mr. Dennant in the map previously referred to. I do not propose to discuss in this present paper their complicated field relations, but merely to indicate a few of the salient features of the trachytes of this district.

A few miles north of Coleraine, and lying just west of the Koonong Wootong Creek, rise two small conical hills, composed of olivine basalt, locally known as Adam and Eve. Through the former of these, on its north side, runs a dyke of light coloured porphyritic rock from west to east. It is from this dyke that I obtained my first specimen of undoubted trachyte in this district. The dyke may be traced west to a low hill where it has been extensively quarried. In the thin slice the phenocrysts of felspar are seen to be monoclinic and of the same type as the felspar in

the Macedon rock and I see no reason to doubt that it is the sanidine varity of orthoclase. The ground mass contains some glass in which are set somewhat short, stout felspars, thus giving the rock the structure designated by Rosenbusch as orthophyric. These minute felspars have well marked crystal boundaries, give straight extinction and show but little tendence to flow arrangement. There is a small quantity of opaque matter disseminated through the base. Apatite is present in rather slender prismatic crystals, but mica, augite and hornblende appear to be absent. The rock must be classed as a trachyte. Possibly its occurrence as a narrow dyke may account for the glass seen in the base.

Further north and on the opposite side of the creek is an outcrop of a rock having a somewhat schistose structure. On examination it is found to consist largely of felspar crystals of columnar habit. In three slides prepared from this rock no glass could be traced, but it may still be there as the dissemination of fine black dust through the base makes the slide somewhat opaque. The matrix of the rock is mainly lath-shaped microliths of felspar arranged somewhat in parallel lines. The felspar phenocrysts are sanidine, showing in almost every case twinning on the Carlsbad law, and very frequently the characteristic rude parting parallel to the face (100). Hornblende is present in grains and ill-formed crystals. Mica, magnetite and apatite may also be traced.

From the low hill lying due north of the Koroit Inn, Coleraine, and just beyond the Koroit Creek, a specimen still more compact in structure and showing smaller porphyritic crystals of felspar was obtained. On slicing it the phenocrysts turned out to be sanidine, while the base was mainly microliths of the same material. Augite quite destitute of crystal boundaries occurs in considerable quantity and magnetite is also present.

A little north of west of the last mentioned hill are several small quarries of what I took to be sandstone. The rock is light gray in colour and medium grained in texture. No phenocrysts can be seen with the naked eye. On slicing the rock I was surprised to find that it is made up almost entirely of felspar crystals. These are monoclinic and on comparison with

the felspars of the rocks previously described from this area I feel no hesitation in classing them as sanidine. Augite and magnetite are present and also a small amount of some secondary chloritic matter.

About two miles east of the town of Coleraine, close to where the Koroit Creek bends west, in a paddock belonging to Mr. W. Young, occurs a hard, dense, black rock of somewhat vitreous lustre. As in the preceding rock, no porphyritic crystals can be noticed, but under the microscope it is seen to be made up largely of felspar microliths showing well marked flow structure. They do not, however, always give straight extinction. The larger felspars are destitute of crystal boundary and appear much eroded; they are sometimes crushed and bent. On the whole I am inclined to regard them as sanidine which has through some physical agency had its characteristic properties somewhat obscured. Augite and magnetite in grains are distributed through the slide. With some diffidence I class this rock—temporarily at least—as a trachyte.

In other places near Coleraine—such as Den Hills and Nareen—rocks somewhat similar to the one last described may be found but in all cases they have undergone so much alteration as to make their determination a matter of some uncertainty.

It will be seen from this description of the Coleraine trachytes that though they present much diversity both of appearance and structure, a regular passage may be traced from the dyke rock in which the sanidine crystals are well developed to the specimen from which phenocrysts of sanidine are absent and in which felspar microliths formed the main part of the mass. It is not clear from the field evidence that all these rocks of trachyte type are of the same geological age but their petrological characters seem to support this view. The discovery by Mr. Dennant in the felspathic tufa on Mount Koroit, near Coleraine, of small blocks containing a Mesozoic cycad—recognised by Mr. Etheridge, junr., as otozamites—may be held to show that, in this part of the field at any rate, there is evidence of either later or post-Mesozoic igneous activity. The field relations of the volcanic cones, Adam and Eve, through which the trachyte is intrusive, suggest that these cones were possibly of submarine origin, and that before extensive denudation had taken place

they were covered by the beds—probably of Miocene age—which form the surface rock over the larger part of the area in which the trachyte is to be found.

A further occurrence of trachyte may be noted at Wanda Dale station, situate about twelve miles N.N.W. of Coleraine. Specimens from this locality contain pellucid sanidine crystals of columnar habit, surrounded by a network of felspar microliths, in which appear granules of hornblende and small specks of magnetite and opaque matter.

Art. IX.—*On Some New Species of Victorian Mollusca.*

By G. B. PRITCHARD and J. H. GATLIFF.

(With Plate VIII.).

[Read 8th June, 1899].

Drillia gabrieli, sp. nov.

Shell, turreted, elongate fusiform, consisting of a smooth convex embryo of about one and a half whorls, succeeded by about six nodose or imperfectly costate whorls.

Apex obtuse, owing to the convexity of the embryonic whorls. Spire-whorls subangulate medially or slightly below the middle, and somewhat overlapping at the suture owing to the presence of a more or less developed narrow sutural band.

The earlier spire-whorls are occasionally somewhat obliquely costate, but more frequently a medial tumidity only is noticeable, in either case the costæ or tumidities tend to become obsolete towards the body-whorl, which is sometimes almost smooth. Fine and somewhat irregular lines of growth mark the shell parallel to the costation or nodulation, and transverse to this are fairly strong spiral threads of two or three degrees of fineness, occasionally slightly irregular or undulating where crossed by the lines of growth.

Aperture narrow-ovate, with a broad deep sinus just above the shoulder. Anterior canal rather broad and short; columella white or whitish brown, and only slightly twisted; posterior end of aperture furnished just below the suture with a somewhat strong tubercle. Outer lip thin and with a sharp edge, smooth within.

Colour, dirty-white, whitish-brown, to dark brown, usually brown.

Dimensions.—Length of type, 16 mm.; breadth, 5 mm.; length of aperture, 6 mm.; breadth of aperture, 2 mm. These dimensions also well represent the usual size of the species, though some examples are a little smaller, having a length of 16 mm. by a breadth of 4 mm.

Locality.—Dredged alive by Mr. C. J. Gabriel from about five fathoms, on a muddy bottom, off Phillip Island, Western Port.

Observations.—This new species is closely allied to some of our undescribed fossil forms of Eocene and Miocene age, but can be readily distinguished upon close examination of the material hitherto examined.

Drillia howitti, sp. nov.

Shell thick and strong, elongately turreted, with a spire about two and a half times the length of the aperture, and consisting of a smooth convex translucent embroyo of about one and a half whorls, succeeded by about seven, gradually increasing nodose whorls.

Apex obtuse, whorls very slightly convex, with a well-marked suture, and a broad flat or very slightly convex area below the suture occupying a little less than half the breadth of the whorls. Below the sutural band the whorls are more markedly convex owing to the presence of smooth oblique nodosities, which number from about ten to thirteen or fourteen to the whorl, usually with thirteen on the penultimate whorl.

The shell is otherwise smooth showing the lines of growth only very faintly.

Aperture narrow-ovate, with a broad shallow sinus fully occupying the flat area below the suture; the breadth of the sinus being somewhat detracted from by the presence of a large and prominent tubercle on the columellar side. Columella white and slightly twisted. Anterior canal very short, but relatively rather broad. Outer lip thin at the margin and smooth within.

Colour, white, creamy, or light brown.

Dimensions.—Length, 13 mm.; breadth, 4 mm.; length of aperture, 5 mm.; breadth of aperture, 2 mm.

Locality.—Gippsland coast.

Observations.—The name is given to the species as a compliment to Mr. A. W. Howitt, F.G.S., who has added so much to our scientific knowledge of the Gippsland area. This species is quite distinct from any described forms with which we are acquainted, but in many respects it is closely allied to some undescribed species from Victorian deposits of Miocene age.

Mangilia flaccida, sp. nov.

Shell narrowly elongate, with a rather acute apex in unworn specimens, but most of the adult specimens hitherto examined appear blunt and obtuse on account of apical erosion.

Embryonic whorls about two, smooth and shining, and slightly convex; the succeeding whorls number about four or five, and are strongly costate.

Spire whorls are subangulate a little below the suture, giving t he latter the appearance of being somewhat impressed. Each whorl bears from ten to twelve strong costæ, usually the former number; the costæ are slightly oblique, are usually narrower than the interspaces between them and extend of a uniform breadth from the anterior suture to the posterior angulation, thence to the posterior suture tapering slightly, and forwardly directed to a slight extent. On the anterior lower half of the body-whorl the costæ are backwardly arched, and thin out towards the columella. The costæ and interspaces are both crossed transversely by fairly strong and intermediate fine series of spiral threads, the strong and prominent threads numbering from three to six to a whorl, with several fine threadlets between them.

In young, and in well preserved adult shells, the coarser spiral threads where they cross the costæ, cause the latter to have a regular beaded or granulated appearance, but in some adult specimens there appears to be a tendency for this tpye of ornament to become indistinct or obsolete towards the body-whorl. Parallel to the costæ fine striæ-like lines of growth are discernible under a lens. Aperture ovate, with a somewhat narrow but well defined sinus posteriorly just below the suture, and with a short broad and shallow anterior canal.

Columella smooth and slightly twisted. The outer lip in adult specimens has a thin edge from the sinus to the anterior lower margin of canal, with a well-marked varicose thickening behind, extending from the anterior canal up to and then round the sinus to the suture, where it thins out in a pad-like form on the inner lip. Outer lip somewhat effuse anteriorly.

Colour white to creamy, with a pale or faded violet-brown broad band on the anterior slope of the body-whorl, and a faint

narrow band near the suture, and usually just discernible above the anterior suture of the penultimate whorl; occasionally darker spots of a brownish colour are to be seen on the costæ of the body-whorl at or a little below the centre of the whorl.

Dimensions.—Type specimen: Length, 9 mm.; breadth, 3·5 mm.; length of aperture, 4 mm.; breadth of aperture, 1·5 mm. Larger examples: Length, 12·5 mm.; breadth, 5 mm. Immature example: Length, 5·5 mm.; breadth, 2·5 m.m

Locality.—San Remo, Western Port.

Observations.—This is probably the shell that has been regarded as Mangilia pura, Reeve, by some South Australian and Tasmanian conchologists, this name appearing in Mr. Adcock's "Hand List of South Australian Species," p. 5, and we have received it under this name from Tasmania. We have, however, been unable to identify any of our shells with Reeve's above species (said to be synonymous with a Mediterranean shell), though the form at present under consideration might possibly be regarded as the closest related. After consideration of Tenison Woods' descriptions we have failed in making an identification, and have therefore been constrained to regard it as a new species.

Cithara cognata, n. sp.

Shell narrowly fusiform, somewhat solid, of six and a half whorls, one and a half smooth nuclear whorls, the four succeeding whorls being longitudinally plicate, about eleven plicæ on the penultimate whorl, following at somewhat irregular intervals, reflected, and more developed at the suture, and tending to become obsolete on the body whorl. Densely spirally grooved, grooves continuing over the plicæ, and crossed transversely by fine striæ and lines of growth, these causing an irregular undulation in the groove, most noticeable on the body whorl. Suture impressed. Aperture narrowly lanceolate. Sinus somewhat broad, well defined. Outer lip at the edge acute, thickened, almost forming a varix, interior smooth. Columella smooth.

Of a pale brown colour, sometimes there are about six white spiral lines on the outer lip, which gradually disappear. Distinctly, irregularly, spotted, with very dark brown,

immediately below the suture on the body whorl; the spots when ascending the spire becoming gradually less distinct.

Dimensions of Type.—Length, 16 mm.; breadth, 6 mm.; length of aperture, 9 mm.; breadth of aperture, about 2 mm. Other specimens range in length from 12 mm. to 19 mm.

Locality.—Dredged alive five fathoms, off Phillip Island, Western Port, by C. J. Gabriel.

Observations.—Our most nearly related species is Cithara compta, Adams and Angas, but it may be readily distinguished from that species by its much narrower form, more lengthy spire, and by its only having about half the number of plicæ on the penultimate whorl. We have named it C. cognata because of this near relationship.

Clathurella sexdentata, n. sp.

Shell solid, narrowly fusiform, of six whorls, one and a half smooth nuclear whorls, the first half turn being somewhat obliquely enrolled to the general axis. Longitudinally plicate, body whorl bearing twelve to fourteen well defined plicæ, which terminate just below the suture; this is well impressed. About sixteen thread-like liræ encircling the body whorl, strongly developed between the plicæ but barely discernible upon them. Aperture narrowly ovate. Sinus well defined, and in juxtaposition to the suture. Outer lip varicosely thickened, with about six elongated denticles within. Columella smooth. Anterior channel open, slightly everted.

White, the liræ being somewhat more opaque than the remainder of the shell.

Dimensions of Type.—Length, 6 mm.; breadth, 2·25 mm.; length of aperture, 2 mm.; breadth, 1 mm. Larger examples attain to a length of 7 mm.

Locality.—Sorrento beach, Port Phillip (Gatliff).

Observations.—In habit and size nearly related to C. modesta, Angas, but the sculpture is finer and differs in character.

Mitromorpha flindersi, n. sp.

Shell robustly fusiform, of five and a half whorls, one and a half smooth nuclear whorls, the remainder densely spirally lirate,

liræ numbering from five to seven on the spire whorls, and about twenty on the body whorl, and being under the lens transversely striate.

Aperture narrowly lanceolate. Outer lip acute, smooth within. Columella slightly arcuate, bearing two oblique plaits about the centre.

White, there is occasionally an interrupted light brown band on the shoulder of the body whorl, and sometimes the encircling liræ are finely dotted with light yellowish-brown; extreme apex usually tinted with purplish-brown.

Dimensions of Type.—Length, 6 mm.; width, 3 mm.; length of aperture, 3 mm.; width, about 1 mm.

Locality.—Flinders beach, Western Port (Gatliff).

Observations.—This shell is nearly allied to M. volva, Sowerby, from Port Elizabeth, "Marine Shells of South Africa," page 7, Plate 1, Fig. 16, and in South Australia, has been identified as such; our species is more robust in form, and the liræ are about twice as numerous as those indicated by Sowerby's figure. This is the first time the genus has been recorded as being on our coast.

Liotia hedleyi, n. sp.

Shell discoid, whorls three and a half, the body whorl is angulated by the uppermost of three prominent spiral keels, which are crossed by about twenty well-defined transverse ridges, causing distinct serration of the keel, from an apical aspect; these ridges are directed obliquely backwards, only slightly noticeable between the suture and first keel, more distinct between that and the second, and continuing so to the umbilical keel, and the interstices are under the lens finely striated, striæ running parallel to the ridges; these fine striæ cause interference with the light, giving rise to iridescence when viewed obliquely.

Aperture circular and continuous, lip broadly margined, the margin being sculptured in a manner similar to the other portion of the body whorl.

Widely umbilicated to the spire, umbilicus carinated, area between the carination and keel concave.

Of a uniform cream colour, slightly tinted with brown.

Operculum concentric, of uniform thickness, concave and shelly on the exterior, which is faintly granular. Horny on its inner face.

Dimensions.—Diameter, 4 mm.; altitude, 2 mm.; inside diameter of aperture about 1 mm.

Locality.—Flinders beach, Western Port (Gatliff).

Observations.—In general habit approaching to L. discoidea, Reeve, but in that species the transverse ridges are only present on the upper portion of the body whorl, and our shell does not attain to one-fourth the size. We have much pleasure in naming the species after our friend Mr. Charles Hedley, Conchologist to the Australian Museum, Sydney, who has done such excellent work in this branch of science.

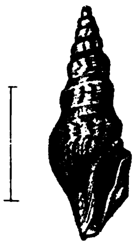
Fig 1.

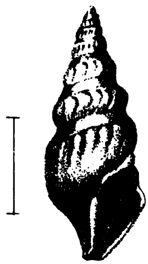
Fig.2

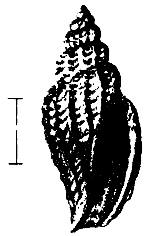
Fig 3.

EXPLANATION OF PLATE VIII.

Fig. 1.—Drillia gabrieli, sp. nov.
„ 2.— „ howitti, sp. nov.
„ 3.—Mangilia flaccida, sp. nov.
„ 4.— „ „ ornament.
„ 5.—Cathara cognata, sp. nov.
„ 6.—Mitromorpha flindersi, sp. nov.
„ 7.—Clathurella sexdentata, sp. nov.
„ 8, 9, 10.—Liotia hedleyi, sp. nov.

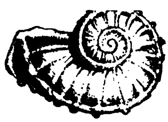
Fig.8

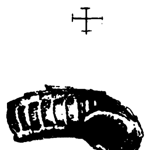
Fig.9

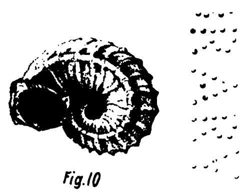
Fig.10

F.E. Grant del. R. Wendel lith Melb.

Art. X.—*On Some Remains of Marsupials from Lake Colongulac, Victoria;*

By C. W. De VIS, M.A.

(Curator of the Queensland Museum);

With Introductory Remarks on the Locality

By T. S. HALL, M.A.

(Melbourne University).

[Read 8th June, 1899.]

Some fossil marsupial remains from the classic locality of Lake Colongulac having come into my hands, I sent the greater number of them to Mr. De Vis for examination, and recently received his report upon them.

The bones were gathered by my brother, Mr. W. A. Hall, and represent only a portion of those which I received from him, those held back not being of any great importance.

Lake Colongulac is one of the numerous shallow lakes which occur in depressions on the basalt lava plains of Western Victoria. It is otherwise known as Lake Timboon, and lies about a couple of miles north of the township of Camperdown. The lake, it may be mentioned, is not to be confused with the railway station, Timboon, which lies some 20 miles south of Camperdown. Camperdown itself is situated just within the southern borders of the great volcanic plain of Western Victoria. The volcanic rocks extend about six miles further to the southward, with a very irregular margin, while to the north they reach some 40 or 50 miles, up to the flanks of the Dividing Range.

Eocene rocks of marine origin occupy the coast line 30 miles south, and appear to underlie the whole of the intervening country from there almost as far north as the volcanic rocks extend, or at any rate as far as the base of the Dividing Range. To the south they are exposed in numerous creek sections along the Curdie and on the banks of the great crater lakes of Bullen-

merri and Gnotuk, close to Camperdown. A mile further north their existence has been proved by well sinkings at Brock's Hill.

The volcanic area is thickly studded with tuff cones, which rarely rise to more than 500ft. above the level of the plain, and the tuff beds are widely spread round the bases of the hills, some of which are of beautifully perfect form. The tuff or ash is locally known as sandstone, and is quarried for rough mason work, no clays suitable for brick-making occurring near Camperdown. The decomposition of tuffs yields the rich soil for which the district is famous.

Round the shores of Lake Colongulac the ash beds are well developed, and seem, judging by their steady dip, to be a part of the deposit which forms the depressed cone which shelters Lakes Bullenmerri and Gnotuk, some three or four miles to the south-west.

The bones, accompained by concretionary nodules of calcareous matter lie loose on the lake beach almost due north of the township, and appear to come from a clay bed which occurs about water level. As the banks of the lake are low it is not easy to say from the evidence there displayed whether the bone bed or the tuff is the older, though my impression has long been that the clay was the underlying deposit. I have recently been informed that in a well-sinking not far from the lake margin, bones were obtained in a clay bed which was reached after sinking through "sandstone." This evidently settles the point, since, as I previously remarked, the tuff is locally known as sandstone.

The tuffs forming the beautiful cone of Mount Leura, which overlooks the township of Camperdown, seem to represent the final efforts of the volcanic outburst, and to overlie those of Bullenmerri and Gnotuk, and it is under these latter tuffs, I believe, that the deposit containing the bones recorded from this locality occurs.

The following species have already been recorded from Lake Colongulac or Lake Timboon, which, it will be remembered, are the same place. The list is compiled from the late Sir F. M'Coy's Prodromus of the Palæontology of Victoria :—

Thylacoleo carnifex, Owen (type locality), Macropus titan, Procoptodon goliah, Phascolomys pliocenus, Phascolomys sp., and Canis dingo.

As Mr. De Vis' report deals with twenty-eight specimens in some detail I have somewhat condensed his remarks, since it seems unnecessary to publish brief cataloguing descriptions of known parts of known species. Mr. De Vis' remarks are enclosed by quotation marks, and a few of my own in square brackets [ ].

"The marsupial jaws which you were so kind as to send to me for examination include representatives of the following species :—

Extinct :— Sthenurus goliah, Owen; Macropus pan m.; Macropus magister m.; Macropus sp. inc.; Thylacinus rostralis m.

Recent :—Macropus giganteus, Shaw.

Of these remains the most prominent in interest are those of Macropus pan, inasmuch as they convey much needed information as to the species, and at the same time correct an error respecting it into which I had fallen. With permission I will take the relics seriatim."

Macropus pan, De Vis.

"Maxillaries, No. 1. Consisting of the palato-maxillary region, with the superposed structures of the base of an adult cranium. From the latter in their present condition we learn little as to any characteristic features the cranium in its entirety may have possessed, further than its total breadth of 121 mm. between the malars. The whole of the cheek teeth are present, and, with the exception of the right premolar, are well preserved. Their facies is partly obscured by adhering matrix; still, there is no difficulty in detecting the species differentiated by their means. The characteristic, more or less lobular offset from the middle of the outer side of the mid-link directed outwards and curving forwards, is well in evidence in those of the molars which are sufficiently exposed. The preservation of the premolar is a fortunate enhancement of our knowledge of the dental characters of the species. This is a bicuspidate tooth, having the anterior cusp short, and in the form of a compressed cone; the posterior a cuneiform, sharp-edged ridge with a shallow, vertical depression on the middle of its outer face; an interoposterior cusp, in the form of a triangular pyramid, is connected by a ridge from its apex with the outer posterior cusp. The dimensions of the tooth

are—length, 10·5 mm.; greatest (posterior) breadth, 6 mm. The entire length of the series of cheek teeth is 68 mm.; the breadth of m^3 is 7 mm."

[Here follow brief descriptions of three unimportant examples of the same species.]

"Mandibles. In the account given of M. pan,[1] it was said that the mandibulary molars are 'undistinguishable from those of M. magister,' but on p. 125 it had been noted that 'the types of the species are the maxillaries alone; there is at present no direct evidence showing that the mandibles are rightly associated with them.' All doubt on these points is set at rest by the examples which now come forward to claim co-specific relation with the maxillaries of M. pan. The mandibles referred to were not rightly associated with the latter, and the true mandibles of M. pan are not as a rule undistinguishable with those of M. magister.

No. 5. Portion of an adolescent, right mandible with m^2, m^3, m^4, remains of m^1, and with p^4 in place; its specific identity is established by the presence of accessory lobules on the inner side of the mid-links; that of m^2 is a sinuous fold of enamel, that of m^3 a vertical plate thickened and curving backwards at its free end. The premolar is bicuspidate, its cusps equal in length, with two or three faint vertical corrugations at their juncture on the outer face; an interoposterior cusp of small size is closely applied to the inner face of the outer posterior cusp, with which it is linked by faint ridge descending from its summit. Dimensions of the tooth, 8 x 5 mm. The length of the whole series of cheek teeth is the same as in the maxillary fossil No. 1.

No. 6. Portion of an adolescent left mandible, with m^2, m^3, m^4, and relics of p^4 and m^1; the accessory fold is wing shaped, that of m^3 a vertical plate as in the previous example. The length of the cheek teeth in this specimen was about 65 mm."

[Specimens 7 and 8 afford no further information.]

"*Macropus magister*, De Vis.

All the representatives of this species are, with one exception, portions of the horizontal rami of the mandibles, the molars are without accessory lobules."

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1 Proc. Linn. Soc. N. S. Wales, vol. x. (1895), p. 127.

[Specimens Nos. 9–20 which are referred to this species are unimportant and merely catalogued by Mr. De Vis. Nos. 21–23 are indeterminate. Of No. 23 Mr. De Vis, says]

"From a young left mandible of a macropod of larger size than Halmaturus cooperi, Owen, but not attaining that of Macropus magister. It would appear to indicate the existence of an undescribed species, but in the absence of the premolar it would not well be differentiated unless, after the removal from the molars of the hard matrix now concealing them, distinctive characters should appear. Teeth apparently m^2, m^3, m^4, ready to emerge, cores of m^1 and p^4; length of the series in use about 40 mm."

[No. 24. Macropus giganteus. The specimen is not mineralized.]

Sthenurus goliah, Owen.

[Nos. 25 and 26 are horizontal rami of mandibles.]

Thylacinus rostralis, De Vis.

"No. 27. Portion of a right maxillary of a Thylacine identifiable with Thylacinus rostralis, but indicating a larger individual than does the type example; teeth preserved, p^3, m^1, m^2, m^3, m^4; length of the series, 66 mm."

Art. XI.—*On the Occurrence of Diprotodon australis (Owen) near Melbourne.*

By G. B. PRITCHARD,

Lecturer on Geology, &c., at the Working Men's College, and Acting Lecturer on Geology at the Melbourne University.

(With Plate IX.).

[Read 8th June, 1899].

A short time ago Mr. W. S. Dawson, M.C.E., of the Metropolitan Board of Works, forwarded to me a specimen for examination and identification, which had been obtained during the course of the sewerage excavations in the neighbourhood of North Melbourne. The specimen proved to be a fairly good example of portion of the lower jaw of *Diprotodon australis*, Owen, and I have to thank the above gentleman for the opportunity of examining it and of recording its discovery, with the accompanying plan of the locality.

The specimen is a fairly large fragment of the right half of the lower jaw, measuring about eight and a half inches in length, and showing portion of the incisor in its socket and indication of the four molar teeth.

The bone is moderately sound and strong, while the teeth are in rather a delapidated condition, very little of the enamel now remaining, and that much cracked and easily broken, but still there is sufficient to show some of the characteristics of the teeth, and the coarse, irregular surface wrinkling of the enamel itself. The fragment appears to have been broken before or perhaps during deposition, as some of the fractures are very ancient, but there are also a number of recent flaws and breaks evidently due to carelessness in excavation.

How much of the incisor tooth there is present it is difficult to say, as the portion still remaining is wholly within its socket; its section is somewhat oval, with its greatest diameter about one inch, and the characteristic external grooving and ridging of this

tooth is clearly shown by the impression on the walls of the socket. The lower incisor teeth of this species, as described by the late Sir Richard Owen, are indicated as being nearly straight, with a length of ten inches, two-thirds of which is lodged in socket, and a transverse breadth of one inch four lines.

The four molar teeth in the present example occupy about seven and a quarter inches of the length of the jaw. There appears to be no trace of the premolar tooth, but the first molar can be recognised by its roots in the jaw, indicating a tooth of about one inch and a half in length. The second molar is much broken, the damage having been done by a pick, but appears one inch and three-quarters long. The third molar is two and a quarter inches in length by about one and a quarter to one and a half inches broad, and the fourth molar is about the same size. These dimensions seem to me to be in very close agreement with those originally given by Sir R. Owen for *Diprotodon australis*, and I therefore identify this jaw as representing his species.

Figures and descriptions of the teeth and other remains of this species may be seen in Sir Richard Owen's work entitled "Researches on the Fossil Remains of the Extinct Mammals of Australia," published in 1877, Plates XIX., XXIII., XXVI., and XXVII., dealing with the above. Sir R. Owen there records *D. australis*, from a gravel bed in the Melbourne District collected by Dr. E. C. Hobson; also from a freshwater deposit in the Province of Victoria, near Melbourne. These localities, however, are so indefinite that they are practically useless.

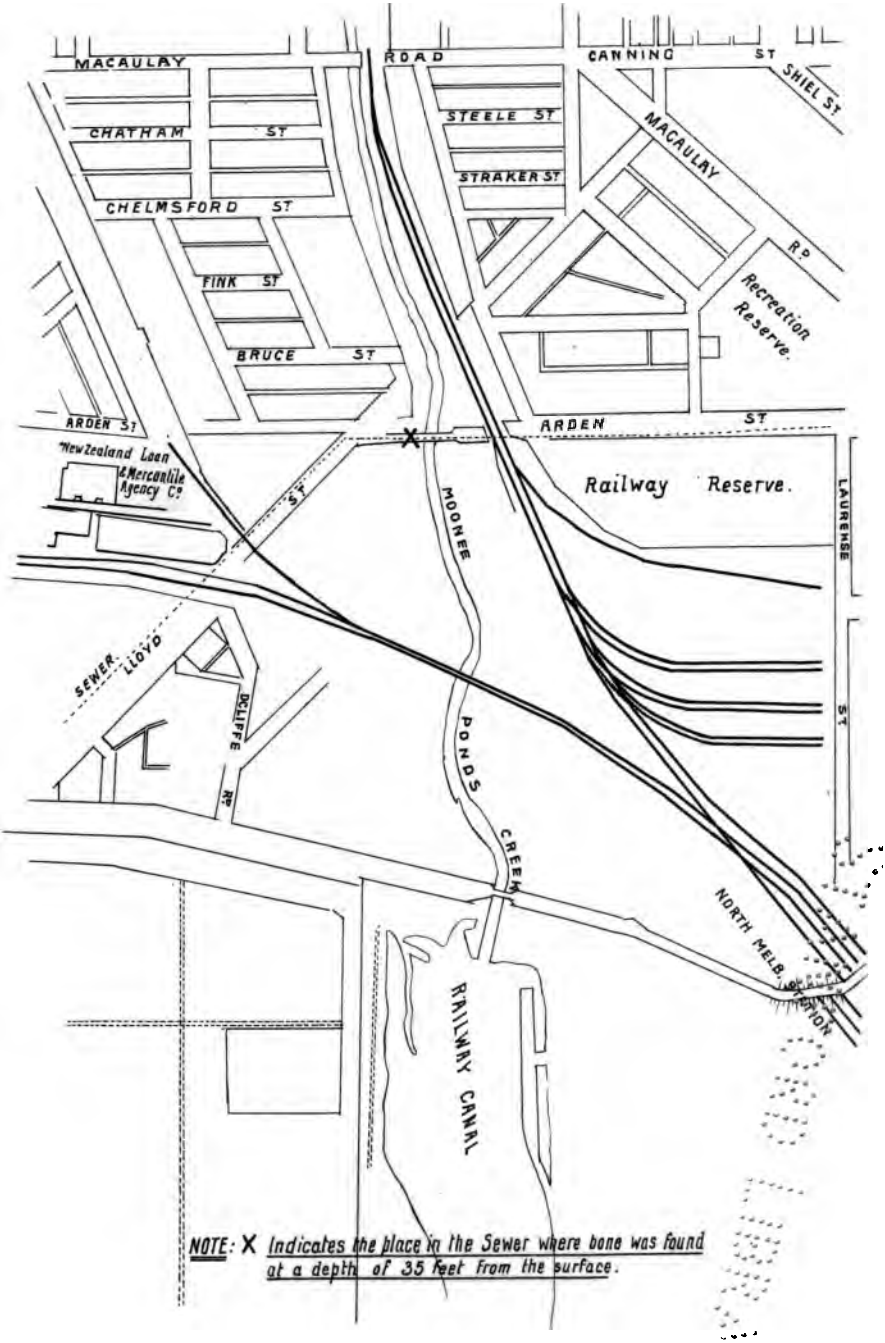
The present example was found in a tunnel excavation under the Moonee Ponds Creek near Arden-street, North Melbourne, the depth of the tunnel below the present bed of the creek being approximately 25ft., or 35ft. below the surface, the exact spot being indicated on the accompanying plan. The matrix in which the bone was found is a sandy clay of a fawn to brownish colour, containing glassy quartz grains up to one-sixteenth of an inch in diameter—some well rounded, while others are sub-angular—and small flakes of a white mica, apparently muscovite.

The discovery of this specimen in this locality is of special interest and importance on account of its bearing on the

geological age of the marine deposits of the West Melbourne Swamp area. In the extension of this same sewer towards Kensington, at a distance of about 200ft. from where the bone was found, numbers of marine shells were discovered, all of which appear to be recent species, and this close association of these remains seems to warrant the application of PLEISTOCENE for the geological age of the deposits in this area.

LOCALITY PLAN

Scale: 800 Feet to One Inch.



NOTE: X Indicates the place in the Sewer where bone was found at a depth of 35 feet from the surface.

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CONTENTS OF VOLUME XII.—Pt. II.

Art. XII.—*On the Age of Auriferous Quartz Veins and Alluvial Deposits in Victoria.*

By W. H. FERGUSON

(Field Geologist, Department of Mines of Victoria).

[Read 13th July, 1899.]

It has occurred to me that a short paper on the period of time in geological history when the auriferous quartz reefs were formed, which are now found in Upper and Lower Silurian rocks in Victoria, as well as some reference to the age of the gravels derived from them may be of interest. Of late years, by boring and actual mining some of the southern leads have been traced to sites near where the ancient rivers debouched into the ancient seas, and their gravels are overlain with marine strata which upon palæontological evidence may be classed as Miocene or perhaps as Eocene.

The finding recently of an auriferous quartz vein in the South Glenfine Mine proves, as many geologists and miners had expected, that along the continuation of some of the belts of auriferous strata reefs exist far out under the basalt of the plains.

It is known that reefs in these positions exist, and that they are covered by gravels, so that it becomes an important question to decide, whether at the time the earliest tertiary gravels were formed, were there then auriferous quartz reefs in existence in the Silurian strata.

Many people are of the opinion that the deposit of gold in our reefs took place in comparatively recent times, not earlier than the Tertiary period. Murray[1] states that Dr. Selwyn considered that payable gold would not be found in Miocene gravels in Victoria. Murray, however, says that Miocene gravels in Gippsland and in the Yarra basin are payably auriferons.

There is, it may be mentioned, some confusion about the use of the term Miocene, as some authors consider some of the strata called Miocene by Selwyn's Survey are really Eocene. Murray

1 Geology and Physical Geography of Victoria, p. 152.

follows Selwyn's use of the term, and I adopt their nomenclature in this paper.

It may be both interesting and profitable to collect the opinions of some leading Victorian geologists on the question under review, for we have gravels of all ages, and if only those of middle tertiary age and those younger contain payable gold, then mining must be greatly restricted to what it otherwise would be if gravels formed from recent times right back to Palæozoic times might be in some places profitably worked for their golden contents.

In a paper read before this Society in 1886, "On the Sedimentary, Metamorphic and Igneous Rocks of Ensay" (pp. 56 to 60), Mr. A. W. Howitt states that in his opinion certain of the sedimentary rocks of the Ensay district were probably altered to schists at the close of the Silurian period, and that the formation of the schistoze structure was probably due to certain conditions arising from the forces which folded and contorted the strata. Also that the Silurian sediments of Gippsland were much folded before the Middle Devonian limestones of Buchan and Bindi were deposited.

Mr. Howitt says further[1] that probably we can refer the formation of the auriferous veins and lodes generally occurring in the Silurian and Devonian formations to plutonic and volcanic action which prevailed about the close of the Silurian period and was continued in Lower Devonian and on until the geological record closes in the Upper Devonian period.

Murray[2] writes that all fissures now reefs, were not formed in one short period, and that most of them resulted from movements connected with, or closely following the corrugation of the strata. The existence of quartz veins in our Upper Palæozoic conglomerates which contain pebbles of water-worn quartz, proves that the formation of quartz veins was not confined to Silurian rocks, though it attained its supreme development in them. Most of the quartz veins in the Silurian rocks of Victoria were formed prior to the formation of the Upper Palæozoic rocks.

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1 In Murray, *l.c.*, p. 147.
2 Murray, *l.c.*, p. 140.

In speaking of the Bendigo rocks Mr. E. J. Dunn[1] says: "There is no evidence that the quartz formed veins in the Silurian rocks before they were bent and folded, but from that time down to the present there is proof that the process has been continually in progress, and quartz veins have formed since the latest known dyke matter was injected." These dykes are supposed to be of tertiary age. The main lines of "saddle-reefs" Mr. Dunn considers to be of vastly greater age.

Mr. E. Lidgey[2] refers the quartz veins of Ballarat to different ages, the cross-courses of the "indicator-belt" being younger than certain main lines which exist on the field, and he states that their formation was probably started when the Lower Silurian rocks of Ballarat were uplifted above the ocean and folded and crumpled.

Mr. H. Herman[3] shows that an auriferous seam occurs in the Upper Devonian rocks of Gladstone Greek, Gippsland, but he does not state at what period the gold was deposited in this seam. From an inspection of his sections, it must have been contemporary with or subsequently to the formation of the Upper Devonian strata.

In Victoria we have cemented and uncemented gravels of many ages from Recent through Tertiary and Mesozoic times to the Upper Silurian period, some of these are auriferous, but geologists differ as to the age of the most ancient gravel which is likely to contain gold, either in payable or unpayable quantity, such gold being of a water-worn character. Murray, in his "Geology of Victoria," writes that much of the stony material and gold of our payable gold drifts was probably disintegrated from matrices and rock masses during Palæozoic and Mesozoic times, and that it is not improbable that some of the lowest beds of the Mesozoic strata between Foster and Turton's Creek may consist of auriferous conglomerates. With this locality I am not familiar. In most places in Victoria where I have noted the beds underlying Mesozoic strata, they are conglomerates formed by glacial or drift-ice action, and the fragments of which they are composed are foreign to the local

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1 Report on the Bendigo Gold Field, Dept. of Mines Special Reports, p. 26.

2 Report on the Ballarat East Gold Field.

3 Trans. Australasian Inst. of Mining Engineers, vol. v., 1898.

bedrock. They appear to be at the base of or older than the Mesozoic strata.

I presume that the conglomerates Mr. Murray mentions were locally formed from the wreck of the Silurian rocks upon which they rest.

The geologists I have quoted all agree that some of our reef fissures in Silurian rocks were filled with auriferous quartz at the time when the Silurian strata were upheaved, folded and crushed, and more or less metamorphosed, and they place that time somewhere between the end of the Silurian period and the final part of the Upper Palæozoic period when a great break in the stratigraphical succession occurs in our Victorian Geology. From my own observations in the field I can agree with the authors whose views I have reviewed, but I go further, and consider it possible that we may have in Victoria an auriferous Upper Silurian conglomerate. To illustrate this opinion I may perhaps be permitted to refer to the geology of the lower part of Wombat Creek, a tributary of the Upper Mitta Mitta River, where there is an unconformable junction between the Lower and the Upper Silurian rocks. The lower series consist of slates and sandstones and quartzites in parts metamorphosed; these rocks are probably of the same age as the schists of the Glen Wills goldfield. Near the Upper Silurian rocks the slates of the older formation are folded sharply into anti- and synclinal folds. From one anticlinal fold, within a chain or two of the conglomerate, I took graptolites, decided by Mr. T. S. Hall, M.A., to be of Lower Silurian age of the Victorian Geological Survey, or as he prefers to call it, Ordovician.[1]

The basal bed of the Upper Silurian rocks is a bouldery conglomerate, some of the stones measuring three feet in diameter. This is succeeded by finer conglomerates, sandstones, shales and limestones; the shales and limestones are in places crowded with corals, shells, and trilobites, determined by Mr. R. Etheridge, jr., to be of Upper Silurian age.[2] Lithologically and stratigraphically the upper and lower series of rocks present a striking unconformability to each other. The upper rocks are not

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1 Proc. Roy. Soc. Victoria, N.S., vol. ix.

2 Progress Report, No. 10, Geo. Survey, Victoria, pp. 100 and 101.

contorted anywhere where I examined them ; the lower rocks are much contorted; quartz veins occur in the folded rocks, and must have been deposited previous to the formation of the Upper Silurian rocks. I may here word my position in this manner, auriferous saddle reefs, and various forms of quartz deposits occur associated with the folding of the Lower Silurian strata at Bendigo and elsewhere. Payable gold has been found in the recent gravels of the upper portions of Wombat Creek, where the rocks are of Lower Silurian age, but lower down the creek where the rocks are Upper Silurian no payable gold has been obtained. Folded strata exist at Wombat Creek in the Lower Silurian rocks, but not in those of the Upper Silurian which overlie them. If any quartz veins exist which are connected with the folding of the Lower Silurian rocks at Wombat Creek, gold from portions of such reefs, etc., may now exist as "alluvial" gold in the Upper Silurian conglomerate, which consists, in part, of the detritus of the denuded Lower Silurian rocks. The Lower Silurian rocks were contorted and denuded before the Upper Silurian rocks were deposited upon them. It does not seem probable that any fissures would long remain open, for if not filled by some precipitated mineral or by a dyke, they would soon be filled by particles of the country rocks scaling off the walls, and a breccia would be formed. I consider it improbable that fissures formed in the Lower Silurian period would remain open and be filled by quartz in any subsequent period. Generally speaking, schistoze rocks are very rare in our Upper Silurian strata, but are abundant in those of the Lower Silurian. At the junction of micaceous and other schists with granite at various places, notably Corryong, there are auriferous contact quartz veins. I consider that these granitic intrusions took place, and the associated quartz veins were formed prior to the formation of the Upper Silurian strata. At Wombat Creek the Lower Silurian rocks are metamorphosed, while the Upper are not. The schistoze rocks of Corryong greatly resemble those of Wombat Creek and between these places there is a general similarity in the intervening metamorphic rocks, which appear to be Lower Silurian strata more or less altered. Within this metamorphic area the unaltered Upper Silurian rocks occur, and I consider that the formation of the auriferous reefs at Corryong was contempo-

raneous with the metamorphism of the strata. At the Golden Mountain Mine, at Bonnie Doon, gold has been mined at the contact of granite with Upper Silurian rocks which are altered by contact metamorphism but a short distance from the junction. I consider that the granite intrusions of Doon took place at a later period than the granitic intrusions of Corryong and Glen Wills; because here Upper Silurian rocks are altered while at Wombat Creek they are not. From the consideration of dykes we may obtain a certain amount of evidence bearing on the age of some quartz veins. In the Upper Silurian Strata the greater number of auriferous quartz veins are associated with dykes, notably diorite; they occur in, and across, and adjacent to the dykes, and are subsequent to them. In the Lower Silurian rocks the reefs are not as a rule connected with dykes, but in some places ancient granitic dykes fault reefs, which are the older. At Wombat Creek granitic dykes occur in the Lower Silurian rocks but were not noted in the Upper series; and if sections were available dykes might perhaps be seen to intersect the Lower rocks but to stop at, and not enter the Upper series, just as in the Werribee Gorge a quartz-porphyry dyke is stated in a note on the quarter sheet of the Geological survey of that locality to intersect the Lower Silurian rocks but not to penetrate the overlying beds of glacial conglomerate.

In a mining item published recently by one of the Melbourne dailies, the statement is made that alluvial gold will not be found far south of the northern fringe of the Pitfield Plains as the marine strata commence there and the alluvial will not extend into them though the reefs may continue further south. I consider that along some of the belts of auriferous country, especially when the gold in the reefs has been of a nuggety character it may pay in places to follow the line of reefs under the marine wash and work for alluvial where the gold has been concentrated by local conditions.[1] To summarize briefly then: I consider that we have no fear of any Tertiary gravels being poor in gold for the reason that auriferous quartz veins were not in existence when they were deposited but that possibly the later formed gravel beds will be richer in gold than the earlier,

1 Murray, *l.c.*, p. 158.

for the reason that the stones and the gold may have formed portion of the mass of some gravel, which was denuded before the formation of the more recent gravel, as suggested by Murray.[1] Also, it is my opinion that we may have auriferous locally formed gravels of any age from Upper Silurian to recent times, and I know of no geological reason why a nugget may not have once existed in a quartz reef in Lower Silurian rocks have been denuded out and have rested for a while in an Upper Silurian gravel, have been washed out again and become locked up in a gravel of Devonian age and have passed in turn through a Mesozoic, and Tertiary and finally, when in a much reduced size be taken from a wash of Post Pliocene age; and that there may exist in Victoria in certain favoured spots auriferous gravels of any age from Upper Silurian to recent.

1 Murray, *l.c.*, p. 155.

ART. XIII.—*Phreatoicoides, a new Genus of Fresh-water Isopoda.*

BY O. A. SAYCE.

(With Plates X., XI., XII.).

[Read 14th September, 1899.]

The specimen under consideration was found by the writer during an excursion in the forest district of Thorpdale, Gippsland; and was taken whilst searching logs of wood dragged from out of a small tributary of the Narracan running through a virgin fern-gully. The water was flowing somewhat rapidly, and it is surprising that, being unable to swim, and also being devoid of eyes, this animal should choose such a situation; however I only met with two or three specimens in the swift running water, and these were taken from crevices within logs lying in the water, and they had possibly been washed down from places where the stream, through the damming back by fallen forest debris, had widened out to form shallow gently running areas, for, on searching in such localities, I found them somewhat numerous and generally in little colonies. From one rotting tree-fern trunk, lying in such a place, on cutting into the fibres, I took as many as nine specimens within an area of six inches.

On examination it has proved to be a form of considerable biological interest, and I desire to record my debt of gratitude to Professor Baldwin Spencer for affording me laboratory facilities, and for his personal interest and help in my work.

From the following description it will be seen to be an Isopod, and, on account of fundamental differences in the pleon from any recorded species, it appears necessary to form a new genus, for which, because of its close affinity to *Phreatoicus*, Chilton,[1] and

[1] In 1882 Dr. Chilton first described the genus in the Trans. N.Z. Institute, vol. xv., p. 89, In 1891 he described a N.S.W. species and considered the position of the genus in the Records Aust. Museum Sydney, vol. i., p. 149, and in the Trans. Linn. Soc. London, May, 1894, he published an important paper in which he slightly amended his generic description, and gave full particulars and drawings of the two New Zealand species, compared them with their probable affinities, and gave other important details, as well as debated some interesting biological questions connected with the Theory of Descent.

Phreatoicopsis, Spencer and Hall,[1] I propose the name of *Phreatoicoides*.

A striking feature about it is that, although inhabiting surface waters, it is blind; and on examining serial sections through the head and brain, I failed to find any definite optic lobes, such as occur in *Phreatoicopsis terricola*, which I prepared for comparison. This points to its near ancestors inhabiting caves or subterranean waters. The New Zealand forms *Phreatoicus typicus* and *P. assimilis*, from subterranean waters, are blind; *P. australis* and *P. terricola*, both inhabiting surface waters, have functioning eyes, the former is recorded from Mount Kosciusko, N. S. W., near the north-eastern border of Victoria, at an elevation of 6,000ft. and the latter from forest country near Colac, in the western district of Victoria. The species under review is from the eastern district of Victoria.[2]

Another noteworthy characteristic of this species is the apparent dimorphism in the males. The only outward difference that I have observed is in the ultimate and penultimate joints of the first pereiopods, which together act as a clasping "hand." The two forms are shown in Figs. 9 and 10. In the one form it is similar to that of all females, but in the other the propodos is very much larger, and the dactylos longer and more curved, showing the peculiarity of the males of the hitherto described species of *Phreatoicus* and *Phreatoicopsis*. The two forms of males noted in the present species are evidently not due to maturity alone, for in Fig. 9 which was drawn from a male of 17 mm. in length, the normal form is shown, whereas in Fig. 10, the male measured only 9 mm. long, and shows the sexual differentiation in the enlarged propodos as described by Chilton, and Spencer and Hall. And further, amongst a considerable number collected I only found three males with the enlarged propodos, none of which were longer than 12 mm. It seems reasonable therefore to consider that in this species mature males exist in two forms.

It is well known that an apparent dimorphism exists in some few widely separate orders of Crustacea, but whether permanent,

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1 Proc. Roy. Soc. Victoria, vol. ix. p. 12.

2 Since writing the above I find that Mr. J. M. Thomson has recorded *P. australis* from pools on Mount Wellington (4,000ft.), Tasmania. Proc. Royal Soc. Tasmania for 1892, p. 76.

or only changing upon the casting of the skin previously to the breeding season and afterwards alternating back again at the next moult, was not known until Faxon kept alive and bred in confinement the fresh-water cray-fish of the United States, *Cambarus rusticans*, Gerard, when he found that the two stages are not permanent "but simply alternating periods in the life of the individual, the 'first form' (so called by Dr. Hagan) being assumed during the pairing season, the 'second form,' during the intervals between the pairing season."[1]

I consider it probable that in the species now under consideration a similar alternation in the males takes place, and I shall describe the structure of the two forms later under the head of Normal and Hymeneal.

Living in the same water as the present species were large numbers of an Amphipod, which, upon superficial examination, appears to be a closely akin genus to *Gammarus*. Also, from a little pool within a few yards from the streamlet, I took another Amphipod, possibly a *Niphargus*, and a small Isopod, of the family *Asellidæ*. These I hope to determine later.

In the following description I have adhered as closely as possible to the arrangement and nomenclature of Chilton, and Spencer and Hall.

Phreatoicoides, n.g.

Body linear, subcylindrical. Upper antennæ short, lower long, with flagellum. Mandibles with an appendage. First pair of legs subchelate, others simple. The legs are divided into an anterior series of four and a posterior series of three. Pleon short, slightly laterally compressed, of six distinct segments, last joined to telson. Pleopoda exposed, foliaceous. Uropoda biramous, styliform. Telson large, sharply truncate.

Phreatoicoides gracilis, n. sp.

Specific diagnosis.—Body slender, greatly elongated, long flexuose setæ scattered sparsely over surface. Pleura of pleon not produced, their inferior margins sparsely fringed with small

1 Faxon, "On the so called Dimorphism in the genus Cambarus." American Journal of Science, vol. xxvii, 1884.

spinules. Eyes not formed. Taking cephalon and pereion as 100, pleon and telson measures $\frac{36}{100}$. Fifth segment of pleon about the same length as the anterior four. Sixth segment very powerful, deeper than anterior ones, narrowly united to fifth segment, measures with telson about the same length as the anterior five segments. Upper antennæ slightly less in length than peduncle of lower antennæ. Lower antennæ about two-thirds of the length of the body; peduncle of five joints, first two short, subequal, remaining three gradually increasing in length, the last being as long as the first three combined. Lower lip two-lobed. Extremity of inner lobe of first maxilla clothed with three plumose setæ, extremity of outer lobe truncate, and bearing about nine spiniform setæ. Legs long, slender. First pair (gnathopods) subchelate, largely developed in some males. Telson abruptly truncate. Uropoda with peduncle, stretching behind the telson; rami as long as peduncle, inner one curved inwards.

Colour.—Creamy-white.

Length.—9–20 mm.

Habitat.—Fresh-water runnel, Thorpdale, Gippsland.

Detailed Description.

The following detailed description is mainly taken from a male specimen 17 mm. in length, and a gravid female of 12 mm. in length.

Body (Plate X., Fig. I).—The largest specimen I have measures 20 mm., and the smallest 8 mm. A female with eggs in the incubatory pouch measures 12 mm.[1]

The body is very slender, and, within narrow limits, uniform in width and depth throughout, except for being deeply cleft ventrally at the junction of the fifth and sixth segments of the pleon, which allows the posterior segment to be flexed acutely downwards. This segment with its uropods acts as a powerful lever to propel the animal forwards.

The dorsal surface is very convex and the ventral surface slightly so.

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[1] In the lithograph, a mistake has been made in the terminal segment, where the articulation of the uropod is made to appear as if with the anterior margin, instead of with the postero-distal margin. Fig. 14 shows it correctly.

The depth through the body measures about 1 mm.

The surface of the whole body is smooth, with long flexuose setæ disposed irregularly over the dorsal and lateral surfaces. At the extreme posterior margin of the head, and of each segment of the pereion, there is a single row of fine setæ pointing backwards. Along the inferior margin of each segment, from the first to the penultimate, short stout setæ are sparsely disposed, while at the posterior inferior angles of each segment of the pereion, except the last, there is a tuft of stout setæ pointing hindward. Upon the epimera also there are a few scattered fine setæ pointing downward.

Head.—The head is longer than the following segment, and also deeper and somewhat wider. The dorsal surface is very convex and curves downwards anteriorly, making the outline, as seen in a lateral view, subtriangular. The anterior margin as seen from above is deeply concave behind the bases of the upper antennæ. The inferior margin is nearly straight for the anterior two-thirds, it is then deflected downwards. At the anterior angle there is a notch above the maxillary palp. Equidistant between the dorsal and ventral surfaces the posterior margin is deeply cut forwards and then downwards to join the deflected posterior margin, so that a large triangular space is formed. At the apex of this triangle a depression runs forward and upward towards the dorsal surface. There is no trace of any eyes.

Peræon.—The *first segment* of the peræon is only about two-thirds as long as the second. The antero-inferior angle is produced forward to occupy the triangular space in the postero-inferior angle of the head. The inferior margin is straight with the exception of the anterior extremity which is produced downward somewhat. The *second*, *third* and *fourth* segments are subequal; the antero-inferior angles of each are rounded off, and the inferior margins slightly concave above the epimera. The *fifth* and *sixth* segments are subequal and shorter than the preceding one, and the *seventh* shorter than the sixth, being of similar length to the first. The inferior margins of each of these last three segments is deeply emarginate above the epimera, which are situated at the posterior extremity of the segments.

Pleon.—The *four first segments* of the pleon are subequal, and measure conjointly the length of the penultimate segment of the

pereion. They are somewhat laterally compressed, and to a very slight extent deeper than the preceding ones, caused by the very narrow pleura. Their inferior margins are convex and bordered by a few spinules. The *fifth* segment is three times longer than any of the preceding four. The dorsal surface curves downward somewhat hindward; its anterior margin is as deep as the preceding segment, but the inferior margin runs upward in a gradual ascent to nearly meet the dorsal surface, so that a very narrow joint is formed with the sixth segment. Its inferior margin is fringed like the preceding segments with scattered spinules. The *sixth segment* (Fig. 14) is completely coalesced with the telson, and measures nearly as long as the preceding five segments. The dorsal surface in lateral view is slightly convex, and in transverse section the sides are deeply arched downwards, and the ventral surface transversely concave. The middle and anterior portion is slightly wider than the posterior extremity, which terminates, a short distance behind the articulation of the basal joint of the uropods, in a widely gaping abruptly truncated telson, very similar in outline, except in the uropods, to *P. terricola* (S. and H.).[1] In lateral view the inferior margin, anteriorly to its insertion with the uropods is, for a short distance, nearly straight and bordered by five spinules; more anteriorly it ascends in a steep grade to its junction with the preceding segments, so that a triangular piece appears as if cut off from this, as also from the posterior end of the preceding segment. The wide space thus left allows of deep ventral flexion of the hind segment. At a distance of about two-thirds the length of the segment the inferior margin ascends vertically to nearly half the depth of the segment, and from this part the peduncle of the uropod of each side arises, which point directly hindward. The inferior margin, from the position of the insertion of the superior border of the peduncle to its termination, is somewhat convex in longitudinal view, and is about one-third the length of the segment. From the posterior dorsal angle of the telson a tuft of long fine spiniform setæ point upwards and hindward, and the posterior margin is sparsely fringed with short setæ.

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[1] *Loc. cit.*, p. 15.

First Antennæ.—The first or upper antennæ are short, scarcely reaching to the end of the peduncle of the second antennæ, and are divided into sometimes nine and sometimes ten joints. The first three form the peduncle, and show a slight difference to the succeeding ones; the *basal joint* is stouter and somewhat longer than the succeeding ones, and the upper margin is slightly concave; it is free from setæ. The *second* and *third* are subequal in length, but the second is somewhat stouter than the third; they are each studded with fine stiff outstanding setæ, and near the distal margin of each are a few very long fine setæ pointing distally. The succeeding joints, composing the *flagellum* are mostly with the exception of the penultimate and distal ones, subequal, and slightly shorter than the last joint of the peduncle, as well as being somewhat thinner. Near the distal margin of each is a series of a few short setæ pointing distally, and very occasionally, from any part of a joint, may arise a single "olfactory" and plumose seta, pointing directly outwards. The penultimate joint is about twice the length of any of the preceding ones, and has a number of setæ near the upper margin. The terminal joint is very short and bluntly pointed, and arising from its summit are tufts of setæ. The setæ are of three distinct kinds, viz., (*a*) so called "olfactory cylinders," (*b*) delicately plumose or feathered setæ, and (*c*) long setæ, which, under high magnification, show the extremity to be cleft into three minute pieces, one of which is slightly swollen and rounded, and having a fine filament leaving it on one side; the other two pieces are pointed, and arched over the rounded piece. At a short distance from the end, there is the appearance of a transverse line. This latter form is situated on the distal margin of each joint. At the end of the last joint, the three kinds are found together.

Second Antennæ.—The second antennæ are about two-thirds the length of the body. The *peduncle* consists of five joints. The first two are short and subequal, the third as long as the previous two combined, and slightly curved, the fourth somewhat longer, being as long as the first three combined. Each of the joints is sparsely setose, while from the terminal margin of the fifth is a series of very long setæ and also a few from the under margins of the third and fourth. The *flagellum* is composed of about twenty-eight joints; the first is twice as long as each of the

succeeding six or seven; more distally they become gradually longer up to the penultimate, which is somewhat longer than the first. Each bears at its distal margin a circlet of short setæ. The terminal joint is short, and bears on its summit a few longer setæ.

The Upper Lip (Fig. 2).—The upper lip is large and strong, broader than long, and regularly rounded at its distal end. The extremity is not produced as in *P. australis*. The front margin is thickly fringed with fine setæ which also clothe the front inner surface.

Mandibles (Figs. 3 and 4).—The mandibles differ in no essential respect from *P. australis* and *P. terricola*. From their basal attachment, which is very wide, they project directly downward and curve inward. On each, at about half their length, a molar tubercle arises from the inner concave surface, and, when the mandibles are closed, the summit of one meets that of the other in the mid axis. The distal or lower half of each of the mandibles rapidly becomes attenuated, continuing downward and curving inward, at the same time twisting round somewhat hindward, to form at their apices the cutting teeth. These also meet together at the mid axis, but more ventrally than the molar tubercles. The anterior margin is somewhat convex; the hind margin gradually becomes narrower as it approaches the position of attachment of the molar tubercle, and is then sharply and deeply cut forward, and then continued downward to the distal extremity. The basal angular piece remaining at the base of the molar tubercle is densely clothed with short setæ. Near the basal attachment of each mandible and close to the anterior margin arises a three-jointed *palp*, which is directed forward and downward. (In the figures they do not lie in their normal position, the ends being displaced somewhat by the pressure of the cover slip used in examination). The first joint is short, the second three times longer, and the third slightly longer than the first. This joint has its upper margin convex and free from setæ, and on the under margin there is a double row of setæ, the first two or three distal ones being very long and incurved, but more proximally they gradually decrease in length. The second and first joints have their upper borders fringed with very short setæ, the under border of the first joint bears two or three

scattered setæ, and also on the under margin of the second joint there are about five very long straight setæ pointing downwards and forwards.

As in the other allied forms mentioned they differ somewhat from each other in the cutting edges, and other minor features.

The *left* mandible (Fig. 4) has the cutting edge composed of two rows of teeth, one on the inner side of the other; they are widely divided distally and united proximally. The outer one consists of four sharp strong teeth, and the inner one of four somewhat smaller teeth. Between these teeth and the base of the molar tubercle the part is twisted somewhat, and on the inner surface is a short outstanding process clothed with a double series of 8-10 short spines. The surface of the molar tubercle is slightly concave and square in outline, and the chitin is formed into numerous small parallel ridges.

The *right* mandible (Fig. 3) has the cutting edge consisting of only one row of four strong sharp teeth; on the inner surface, between these and the base of the molar tubercle is a slightly raised cushion, bearing three short, and one longer, stout spinules, and near these is a bunch of five pectinated spines. The right molar tubercle is somewhat longer than the left and the surface somewhat smaller, but in other respects is similar.

In use the cutting edge of the right mandible passes between the double row of cutting teeth of the left mandible, and in so doing incises the food, at the same time the molar tubercles meet together to act as grinders. From the figures this is difficult to comprehend on account of the difficulty of showing the twisted distal half, the shading of which would obliterate the details of structure.

Lower Lip (Fig. 5).—The lower lip is similar to *P. australis* consisting of two lobes, widely separate distally, but united proximally; and the ends are rounded, and they and the inner margins are densely fringed by inwardly pointing setæ, and the outer margins fringed by much shorter setæ.

First Maxilla. (Fig. 6).—The first maxilla agrees in outline with *P. australis* and consists of two parts, of which the outer is somewhat the longer and stouter; they both curve slightly inwards; the end of the *outer lobe* is truncate, and clothed with eight or nine pointed spines which gradually become shorter from

the outer side inwards. On the outer surface there are two positions bearing setæ, viz., at the base where there are about five, and towards the distal end about twelve. On the inner surface, midway between its union with the inner part and the distal end there are about five setæ. The *inner lobe* has its end somewhat rounded and bearing three long plumose setæ, and near the inner margin two single spines. Proximally on the inner surface there are a few short setæ, and along the outer surface are long setæ sparsely disposed, which point distally.

Second Maxilla (Fig. 7).—The second maxilla consists of a basal portion, produced at its inner distal end into a rounded elongate lobe. External to this articulate two lobes, similar to each other, which are slightly longer than the inner lobe and more slender. Along the inner face of the inner lobe are numerous long spinose setæ, pointing distally, gradually decreasing in length from the base upwards; on the rounded distal end are twelve or more long pectinated setæ. The ends of the two articulating lobes are obliquely truncate, with the face directed inwards, and bearing numerous long awl shaped pectinated setæ. The remainder of the lobes are unclothed.

Compared with *P. australis* the only marked difference is that the present species has the lobes relatively longer in respect to the base.

The Maxillipedes (Fig. 8).—Compared with *P. australis*, the maxillipedes are almost identical; they however bear slightly longer setæ, and the terminal joint is longer and more pointed. The *coxos* is short and irregular in outline; the *epipodite*, arising thereform, bears, on the outer side, a large flat plate reaching beyond the end of the ischios; it is broadly elliptical in outline, with the margin entire. The *basos* is quadrangular, and about three times as long as broad. Joined to the inner margin of the basos for nearly its whole length, and running parallel with it, and situated at right angles to its upper surface, is an accessory flat plate, which leaves the basos proper near its distal extremity and extends beyond as far as the end of the meros, and terminates in a gradually narrowing and bluntly pointed end. In Fig. 8 this plate is turned on one side and pressed down, and therefore showing the inner lateral surface uppermost. Its dorsally situated margin, (right-hand side in figure) up to the end of the

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basos pròper, is clothed with fine setæ, and beyond this, and extending to the extremity, are long pectinated spines pointing distally on the lateral inner surface; between the basos proper and the free extremity, are three equi-distant "coupling spines." The *ischios* is short, transverse, and bears two or three setæ at the inner distal angle. The *meros* is subtriangular, the outer pointed distal extremity bears a few long curved setæ pointing distally, and the inner margin is convex, with five or six long straight setæ. The *carpus* is somewhat sunk in the meros, narrowed at the base, widens distally, and has the end truncate; the inner and outer margins are both convex, the former bears one or two curved setæ, and the latter is densely fringed, from end to end, with long outwardly directed setæ. The *propodos* is oblong, the outer margin sparsely setose, and the inner densely fringed with long setæ. The *dactylos* is of the same length as the propodos, but much narrower, bluntly pointed, and incurved. The outer convex margin is free from setæ, and the inner concave margin has a fringe of long setæ, and from the extremity arise about five long setæ, of similar kind and length to those of the inner margin.

First Appendage of Pereion.—There are two forms of the first appendage of the pereion found in adult males *(vide ante)*, described hereunder as Normal and Hymeneal.

Normal form of pereiopod of male and female.—The normal form of the first pereiopod of the male is similar to that of the female, so that Fig. 9, drawn from the inner surface of an adult male, will illustrate both male and female. The basos and ischios combined measures slightly longer than the next three succeeding joints, the *basos* being somewhat the longer of the two. It is narrow at its articulation with the coxa, gradually widening to the proportion of two and a half times longer than wide, and again constricting distally; on the inner surface, near the distal margin, is a small tuft of long setæ; the anterior margin is sparsely setose. The *ischios* is of the same shape as the basos, but somewhat shorter and the anterior is sparsely setose. The *meros* is half the length of the ischios, and subtriangular in outline. The anterior margin is produced into a pointed projection, from the extremity of which arises a tuft of long spiniform setæ; the posterior margin is straight and sparsely setose; and

the distal margin is produced obliquely downward from the hinder to the front margin, and overlaps the junction with the carpus. The *carpus* is also subtriangular, the base of which forms the distal margin. The posterior margin is fringed with setæ. The *propodos* is oblong, in the proportion of its length being two and a half times the width, and its length measures two and a half times that of the two previous joints combined. The joint attenuates somewhat distally, and the anterior border in side view is curved from the proximal to the distal extremity, and is clothed in three places with a few long setæ. The posterior border is straight and forms a narrow palm, against which the dactylos, which articulates at the distal extremity of this border, can shut. Along the sides of the palm is a fringe of spiniform setæ. The *dactylos* is nearly as long as the propodos, slightly curved inwards, with the margin entire, and terminating in a strong sharp point. Along its inner margin are a number of very long filamentous setæ, and on the outer surface, near the distal extremity, is a small tuft of short sensory hairs, similar to form C previously described, and more proximally a few short setæ.

Hymenial form of pereiopod of male.—The only marked difference in the hymenial form is in the propodos and dactylos. Fig. 10 is a drawing of the inner surface of a smaller male than the preceding one, viz., 9 mm. The *propodos* will be seen to be much wider; the palm is slightly concave and there is a conical projection at its proximal end tipped with sensory hairs; there are no setæ on the convex anterior margin except at the extreme distal end. The *dactylos* is longer and more curved than in the normal form and tipped with a greater number of sensory hairs.

Second, Third, and Fourth Pereiopods.—The second, third, and fourth pereiopods are similar to each other (Fig. 11 is a drawing of the outer surface of the third and will sufficiently illustrate the other two). The *basos* and *ischios* are similar to the first pereiopod. The *meros* is sub-equal. The *carpus* is oblong and almost as long as the meros; the posterior margin bears a series of eight long stout spines, pointing distally, and from the antero-distal angle there is a tuft of long setæ like those in a similar position on the meros.

The *propodos* is subrectangular, of equal length to, but narrower than the carpus. About half the distance along the posterior margin there are two long spines, pointing distally; the antero-distal angle is tufted with long setæ, and the anterior margin sparsely setose.

The *dactylos* is short, slightly curved hindward, and ends in a strong pointed tooth; the posterior concave margin also bears a stout tooth, and the anterior margin is sparsely setose. The fourth pereiopod is not modified to form a clasping organ as in *Phreatoicus.*

The Fifth, Sixth, and Seventh Pereiopods.—The fifth, sixth, and seventh pereiopods are each similar in form to one another, but each is longer, and proportionately larger in all parts, than the immediately preceding one. The fifth is of equal length to the fourth, and the seventh is about one third longer than the first. (Fig. 12, drawn on a smaller scale than the first, illustrates the seventh, with the inner side uppermost). They each fit into a triangular emargination at the posterior limit of each segment, and are reversed in the manner of articulation to the preceding four appendages. Their appearance is so much like those of *P. australis* that a detailed description of them is unnessary. In marked contradistinction the setæ of the present species is somewhat longer but not so numerous, and the terminal joint is not toothed.

The Pleopods.—The pleopods are all branchial in function, and the second pair, in the males, possess each a "penial filament" (Fig. 13). They are large and well developed, and hang from the ventral surface free from an operculum or any protective process. In fundamental features they are like *Phreatoicus* except in not having a distinct process in the third, fourth, and fifth pairs, thought by Chilton to be an epipodite, and also shown by Spencer and Hall to exist in *Phreatoicopsis*; and further, they are not protected by an extended pleura, as in the recorded species of the two mentioned genera. Each succeeding pair slightly diminishes in length hindward. The endopodite is in no case setose, and there are no plumose setæ on the exopodite as in *Phreatoicus.*

First pair of Pleopods—In the first pleopod the *protopodite* is subrectangular in outline, with a tuft of long stiff setæ on the

inner surface, the outer margin is free. The *endopodite* unites with the protopodite just below the tuft of setæ; it is narrow—elliptical, with the margins entire, and the extremity rounded.

The *exopodite* unites with the propodite at its distal extremity, slightly below the junction of the endopodite. It is oblong, three times longer than broad, and somewhat longer than the endopodite, and reaches to about the level of the distal margin of the ischios of the seventh pereiopod; the inner margin is straight and free from setæ; the upper margin is deeply convex, and the outer margin descends in irregular outline, gradually rounding off distally to form a bluntly pointed acute distal inner angle; along this convex margin there are long filamentous setæ sparsely disposed, but most numerous distally.

Second pair of pleopods (Fig. 13).—The *propodite* of the second pleopod is subequal to the first, but the inner and outer margins are deeply convex. The *endopodite* is not so long, and is joined to the propodite by a thick peduncle, from which, in the male, arises the penial filament. This is a narrow somewhat curved process, gradually tapering to a point, slightly constricted at its proximal end, and reaching to below half the length of the endopodite; its inner surface is deeply grooved longitudinally.

The *exopodite* is similar in general outline to that of the first, except that towards the distal end a jointed small narrow lobe arises from an emargination in the inner margin, situated a short distance below the level of the distal extremity of the endopodite, and hangs vertically downward along side of, and parallel with, the continued inner margin of the large basal lobe, and extending somewhat below it; the inner margin of the large lobe is thickly fringed with short setæ as far as the insertion of the small lobe, and from there to the extremity it is bare; the margin of the small lobe which appears as a continuous line with the inner margin of the large lobe is similarly fringed with short setæ, which gradually lengthen distally, and continue along its rounded extremity. The distal margin of the large lobe bears a few long filamentous setæ, and on the upper half of the outer convex margin there are longer filamentous setæ, somewhat thickly disposed, and between these two regions there are a few short scattered setæ; also over the flat surface of the lobe there are a few irregularly scattered setæ. In the *female* the appendage is similar in form except in not having a penial filament.

Third, Fourth and Fifth pairs of Pleopoda.—I shall describe these together. The *propodite* of each is subequal in shape to the preceding one with the addition of a swelling on the inner surface of each, which is most marked on the third, appearing there as a bluntly rounded prominent tubercle clothed with short setæ. There is no so called epipodite, as shown by Chilton to exist in *Phreatoicus*, and also by Spencer and Hall in *Phreatoicopsis*.

The *endopodite* of each is broader and shorter than the second, the fourth is shorter than the third, and the fifth very much shorter than the fourth. In other respects they are similar to each other. The *exopodite* of each becomes gradually broader and shorter than its antecedent, but in general contour and disposition of setæ they are similar to the second. The accessory lobe in each becomes shorter in a similar way and degree as in the endopodites.

The Uropoda (Fig. 14).—The *uropoda* point distally and are very strongly developed. The peduncle stretches considerably beyond the end of the telson; its lower margin is straight and sparsly setose, the upper margin is bluntly serrated, and bears a few short setæ. The *outer ramus* is equal in length to the peduncle, and arises from above the insertion of the inner ramus; in shape it is styliform, terminating in a strong acute point, at the base of which arise, on the upper and outer surfaces, numerous very long spinose setæ, which project backwards and outwards. The *inner ramus* is similar to the outer one except in being slightly longer and curving inwards so as to cross the inner ramus of the other side.

Gravid Female.—In a female, with fully developed incubatory pouch, measuring 12 mm. long, the pouch occupies an area under the first to the fifth free segments of the pereion, and reaches ventrally to near the distal extremity of the ischios of the third pereiopod. In outline the anterior, posterior, and ventral margins are deeply convex. It is formed of three pairs of thin transparent lamellæ (oostegites) produced from the inside of the basal joint of the antipenultimate and succeeding two pairs of pereiopods, which overlap each other along the lateral borders, and incurve ventrally to overlap those of the opposite side, and so form a spacious pouch, containing about twenty light yellow-

coloured eggs. The lamellæ are each subspherical in outline, with margins entire.

Sexual differences.—The only external differences in the form of the female from the hymeneal male are that the first pereiopod, which is similar to that of the normal male, has not the largely developed clasping hand characteristic of the hymeneal form; there is no external male organ at the base of the seventh pair of pereiopods, and no penial filament on the second pair of pleopods, and when breeding there is a specially developed pouch.

Generic position.—The nearest ally to the present species is *Phreatoicus australis*, and, compared with that species, there is no great difference in the head and pereion and their appendages, except that in the present species the pereion is relatively much more slender, but in the truncated telson it more nearly resembles *Phreatoicopsis terricola.* The difference however in the pleon, both in its relative length, which is short, and in the pleura being unproduced, mark it off from either of the above genera, and make it necessary to form a new one for its reception.

The measurement of a number of different individuals of the present species showed an invariable degree of comparison between the length of the pleon and telson to that of the cephalon and pereion, and herewith I append the proportions of other allied forms, which I measured from the drawings of Chilton, and Spencer and Hall. Taking the cephalon and pereion combined as 100, then the pleon and telson combined measured in the following species as under:—

Phreatoicopsis gracilis - - -	$\frac{36}{100}$
Phreatoicus australis - - -	$\frac{58}{100}$
„ assimilis - - -	$\frac{61}{100}$
„ typicus - - - -	$\frac{63}{100}$
Phreatoicoides terricola - - -	$\frac{60}{100}$

DESCRIPTION OF PLATES.

Plate X.

Fig. 1.—Side view of *Phreatoicoides gracilis*. × 11. (The terminal segment has been mistakenly transcribed; the uropod should not articulate with the anterior margin, but with the postero-distal margin as shown in Fig. 14).

Plates XI. and XII.

Fig. 2.—Upper lip. × 42.
" 3.—Mandible of right side. × 42.
" 4.—Mandible of left side. × 42.
" 5.—Lower lip. × 42.
" 6.—First maxilla. × 42.
" 7.—Second maxilla. × 42.
" 8.—Maxillipede seen from above. × 42.
" 9.—First appendage of pereion. Normal form of male. × 42.
" 10.—Portion of first appendage of pereion. Hymeneal form of male. × 42.
" 11.—Portion of third appendage of pereion. × 42.
" 12.—Portion of seventh pereiopod. × 35.
" 13.—Second pleopod of male. × 32.
" 14.—Terminal segment. × 40.

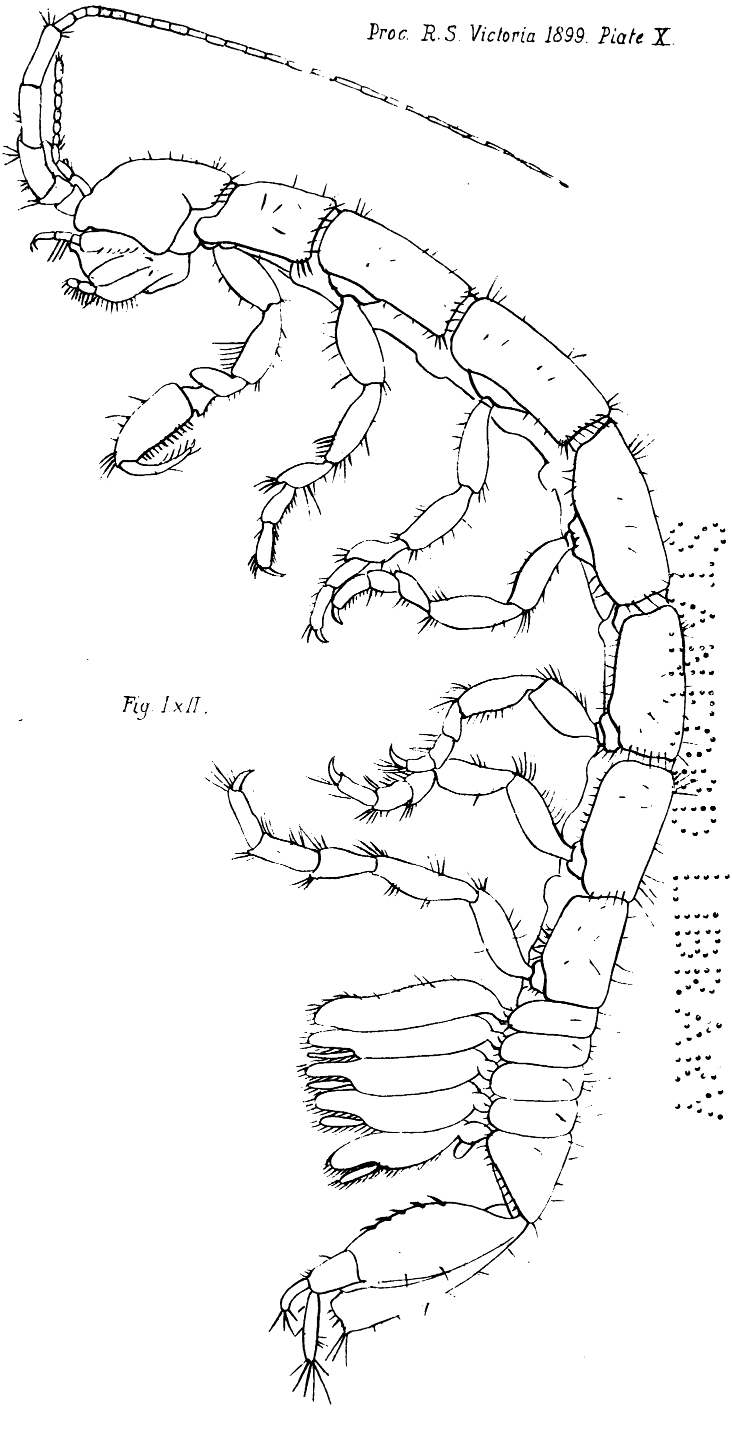
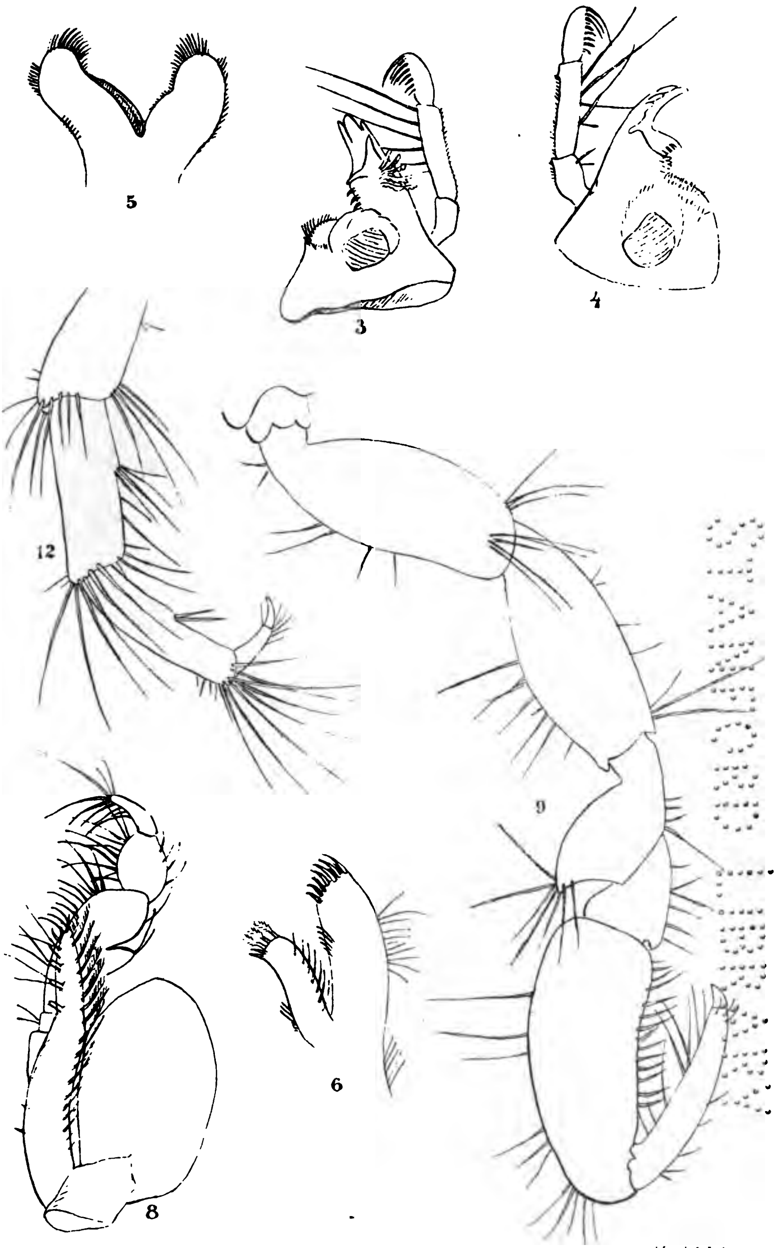
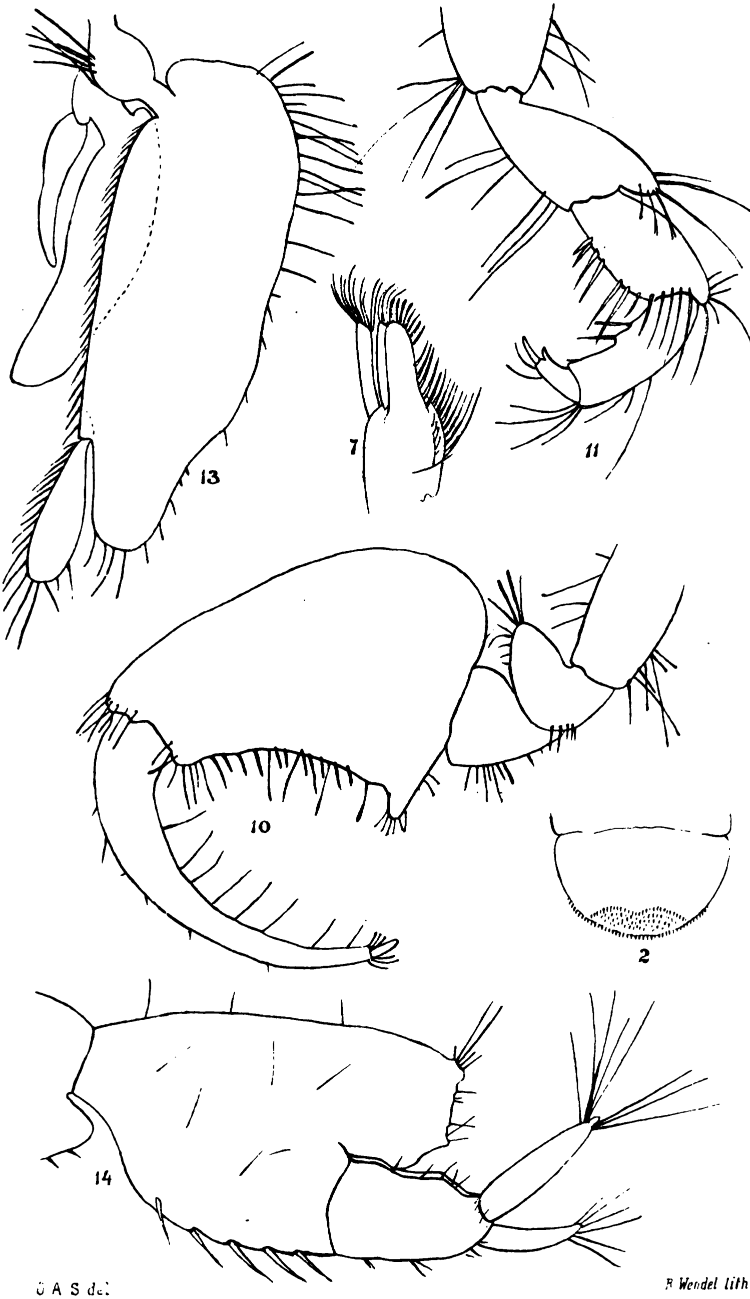


Fig. 1 × 11.



O A S del.

... Wendel lith



G A S del.

R Wendel lith.

Art. XIV.—*Note on a Basalt Tree Cast.*

By R. H. WALCOTT, F.G.S.

(With Plate XIII),

[Read 13th July, 1899].

In the Industrial and Technological Museum Collection there is a specimen which perhaps stands unique as a remarkable geological curiosity. It is what appears to be the cast of a tree in basalt which was found in the quarry of Mr. John White, at Footscray, by whom it was exhibited at the Melbourne Intercolonial Exhibition of 1866. Along with many other objects from that Exhibition it was presented to the Trustees of the Public Library and assisted in forming a nucleus for the present Museum Collection. Unavoidably the specimen was broken into many pieces in removing it from the hard enclosing basalt and consequently it remained in an obscure corner of the old building for many years, an unsightly object attracting but little attention. On the removal of the collection to the New Museum, the late Superintendent had each section properly secured in its original position by stout iron pins and cement, so that the true nature of the specimen is now plainly revealed. The restoration has been the means of considerably increasing the amount of interest previously taken in the exhibit but without evolving any more feasible theory for its origin than that already advanced.

The tree consists of a slightly curved stem with an average circumference of 31 inches, the top or point of branching being only 1½ inches less than that near the root junction at which point the stem is abruptly constricted.

It is supported on several short roots, or better perhaps, portions of roots, and carries one branch 4½ feet long.

The branch, which is also slightly curved, has an average circumference of about 19 inches with a small taper, the end being rounded off. It diverges from the vertical at an angle of about 30 degrees. At the branch junction the stem bears two depressions, one being large and situated on the top of the stem,

the other smaller and carried on a prominence at the side. Both these structures are evidently scars left by old limbs which were lost long before the advent of the lava streams. From the larger depression a groove, becoming gradually shallower, extends downwards, and on the opposite side a similar but smaller groove appears. The vertical height of the tree from roots to tip of branch is 10 feet. The surface bears a number of corrugations and has the identical appearance of bark. The basalt of which the tree is composed seems to be of the ordinary vesicular variety and calls for no special notice. Its nature is evident from a macroscopic examination, and a microscopic investigation was deemed unnecessary and valueless. On one side of the stem a portion is seen to be composed of a different material. It forms a crust about $\frac{3}{8}$ of an inch in the thickest part and consists of quartz sand, clay and calcium carbonate. Where intact the surface of this crust is indistinguishable from the remainder and the basalt underneath is comparatively smooth and exhibits none of the characteristics observed elsewhere. The surrounding basalt comprising the mould in which the tree was formed, judging from the two available pieces, is to all appearances of the same nature as the cast. It has a light coloured coating and shows very distinctly an impress as of bark. The latter fact supports strongly the contention that the specimen is a cast and not a result of concretionary action.

In dealing with this subject care must be taken not to confuse it with what are generally known as fossil or petrified trees. These are comparatively common and are the result of a gradual replacement of the organic material of the trees by some mineral substance, usually silica, derived from the circulation of waters holding it in solution. Tree petrifactions are so complete in some instances that the woody structure is preserved in perfect detail; they are in fact pseudomorphs by substitution, bearing the form and structure of wood but possessing a mineral instead of an organic composition. In the present instance, however, the original body has first been entirely removed, leaving a cavity or mould which has been subsequently filled by a molten mass of lava. The cast retains the external appearance of a tree but is quite devoid of all other similarity, the interior only showing a basaltic structure.

Mr. Brough Smyth[1] refers to this specimen but hesitates to give an opinion on such an occurrence, as the imitative forms approach so closely to the natural. He mentions the behaviour of lava currents in wooded districts as described by Mr. Dana[2] in his account of the Kilauea Eruption of 1840. As this has a direct bearing upon the subject it will be of interest to repeat it here:

"The lava sometimes, as in other eruptions, flowed round stumps of trees; and as the tree was gradually consumed it left a deep cylindrical hole, either empty or filled with charcoal. Towards the margin of the stream these stump-holes were innumerable; and in many instances the fallen top lay near by, dead but not burned. . . . . .

"The rapidity with which lava cools is still more remarkably shown in the fact that it was found sometimes hanging in stalactites from branches of trees; and although so fluid when thrown off from the stream as to clasp the branch, the heat had barely scorched the bark."

This being an authentic record of the formation of tree moulds in lava, it is perfectly reasonable to assume that had another flow spread over this one at a later period, a number of casts similar to the one under discussion would have resulted.

With regard to the point mentioned by Mr. Brough Smyth that imitative forms at times closely approximate to the natural, it must be observed that nearly all such forms are noted in sedimentary rocks when they are mostly due to the segregation of mineral matter taking place after the formation of the rock itself. Concretions in the true sense, I believe, are practically unknown in undecomposed volcanic rocks. At times, especially in slow flowing lavas, their surfaces exhibit peculiar ropy and other forms produced by the molten lava in the interior moving more rapidly than that at the surface and causing the chilled crust to twist and wrinkle. This structure, however, is quite foreign to the case in view and merely mentioned as being practically the only forms of lava possessed of anything approaching an imitative character. As this is the only alternative

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1 "Gold Fields and Mineral Districts of Victoria," 1869, footnote page 51.

2 "Characteristics of Volcanoes." James D. Dana, 1890 ed., page 64.

suggestion brought forward, we may I think, safely reject it and accept the cast theory as being perfectly satisfactory and consistent with observed occurrences. It is certainly an isolated example, as far as can be ascertained, but when we consider the small extent of quarrying to which lava flows have been subjected and the unusual conditions necessary for the production of basalt tree casts that fact should not influence our acceptance of this explanation.

In the absence of authentic data we must be guided by the features which the specimen itself offers, in attempting to trace out the history of its formation.

In the first place a necessary condition for the preservation of the tree form would lie in its being rapidly surrounded by the molten lava so that the carbonized remains would be inaccessible to the air, and maintain the mould in its proper shape until the lava had cooled sufficiently to prevent it from closing in. This implies a rather fluid state of the lava, because, had it been a viscid mass slowly advancing, it is probable that the tree would have been completely destroyed before it was enveloped and protected from this otherwise inevitable fate. Close examination of the specimen does not reveal any point which can be satisfactorily considered as representative of the lava inlet to the mould. It is therefore not quite evident what position the tree occupied when it was ingulfed in the rapidly flowing lava stream. If the superficial crust previously mentioned can be taken as an integral part of the cast, although of different composition, it must be composed of detrital matter which has been carried mechanically into the mould during the interval which elapsed between the successive lava flows, and after the charred remnants of the tree had been removed. It is certainly not a decomposition product of basalt, the quartz grains being of course quite foreign to that rock, and, moreover, the crust is sharply defined and easily detached from the stem without showing the usual gradation of decomposition, so that it must have been derived from some outside source. Should this view be correct, then the tree must have been in a more or less horizontal position, for had it retained its upright position any detrital matter would naturally have gravitated to the bottom of the mould and formed the lower part of the root cast. In order to provide an entrance

for the lava to the mould we have two alternatives; either the first flow could not have completely covered the tree leaving some portion projecting above the surface as exemplified at Kilauea, or else the tree was completely covered by perhaps many feet of basalt, which has in the course of time through denudation been gradually removed until the mould was reached and rendered accessible to the succeeding flow. The latter view does not seem probable, because even provided that the charred remains of the tree were removed from the cavity the products of decomposition and detritus from the surface would have to a large extent, if not completely, filled it and prevented anything like a perfect cast being formed. Besides this, by the time the mould was reached decomposition of the basalt forming it would in all probability have advanced so far as to destroy the clearness of the mould. The first alternative seems most satisfactory and presuming that the tree occupied a horizontal position it would mean that the lava sheet could only have attained a thickness of about 2 feet at the point where the tree was buried, and even if an upright position had been maintained its thickness could not have been more than 10 feet. Molten lava streams obey the laws of all liquid bodies and, therefore, in their movements resemble water-courses, following valleys and forming streams of sometimes great thickness, where the country is hilly or mountainous, and flooding it when it assumes a slightly undulating or level character. The tree may then have been growing in comparatively flat country, or on an eminence when it was borne down upon by a flow of molten lava, and unable to withstand the weight of the advancing mass was forced down before it breaking its roots off short by the stem and then rapidly being almost covered by the flow. The length of time which then elapsed, during which the mould became freed of the carbonized remains of the tree, and the advent of the succeeding flow in the absence of authentic data are problems difficult to explain. It may have happened that the tree remains slowly smouldered away, a supposition entailing a coolness of the basalt in the immediate vicinity of the mould, which otherwise would have rapidly closed. We have seen that lava in a highly molten state thrown on to tree branches has done no more than scorch the bark, and also that tops of trees which have been enveloped

by lava lay on the surface dead but not burned. No doubt cooling is very rapid at the surface of the flows or when lava occurs in small isolated masses, but it is a well known fact that lava remains molten at a short distance from the surface for a very considerable time. At Vesuvius it is commonly observed that the lava is glowing hot a few inches from the surface long after the flow has taken place although the surface itself can be walked on with impunity. Probably contact with the tree would be sufficient to cause a local cooling assisted further by the porosity of the charcoal permitting access of air. We must also remember that it is assumed that the flow at this point was comparatively thin, perhaps attaining only a few feet in thickness, and that it was cooling both from top and bottom so that it is quite likely the flows succeeded one another within a comparatively short time and before much debris had accumulated in the mould. Most of these points might have been settled by the proprietor of the quarry, but up to the present enquiries for him have been fruitless and I have not yet been able to locate the quarry, nevertheless this note will at least serve as a record of this interesting occurrence.

Art. XV.—*Description of a New Lizard from Northern Queensland.*

By A. H. S. LUCAS, M.A., B.Sc.,

and

C. FROST, F.L.S.

[Read 12th October, 1899.]

Hoplodactylus tuberculatus, sp. n.

Head large, oviform; snout rather longer than the distance between the eye and the ear-opening, once and three-quarters the diameter of the orbit; ear-opening round, half the diameter of the orbit. *Body and limbs* moderate Toes slightly webbed at the base except outer two. Digits dilated as in *H. pacificus*, the length of the slender distal part about equal to that of the dilated portion, and nearly four times the width; about ten lamellæ under the fourth toe, all nearly straight. *Upper surfaces:* Snout covered with large granular scales, the rest of the upper surfaces with granular scales interrupted by numerous blunt, conical, smooth tubercles, recalling those of *Gymnodactylus pelagicus* in size and arrangement but less regularly disposed in linear series on the back, twenty four such longitudinal series on the dorsal region, tubercles small on head and fore-limbs, largest on back, root of tail and hind-limbs. Rostral twice as broad as high, with median cleft above extending nearly half way to the free edge of the scale; a pair of supranasals succeed the rostral, and are separated by a small scale in the median line; nostril pierced between the rostral, first labial, supranasal, and four small scales; 12 or 13 upper labials and 10 or 11 lower, including the smallest. *Lower Surfaces:* Mental smaller than rostral, triangular; three pairs of chin-shields, inner largest, outer granular scales adjacent to the labials much larger than the minute gular granules; abdominal scales larger, flat, hexagonal; a median series of wide scales under the tail. Tail cylindrical, tapering to a fine point, one fourth longer than the head and body.

Colour (of spirit specimen): Ground colour of dorsal surfaces light purplish or pinkish-grey with dark brown cross bands, broader (on the tail much broader) than the interspaces of ground colour between them; the first of these U shaped, extending from the back of the orbit, behind the occiput to the orbit on the other side; the second, in front of the fore-limbs, three between the fore and hind-limbs, one between the hind-limbs and ten of gradually decreasing size and distinctness on the tail. Under surfaces uniform pinkish grey.

DIMENSIONS.

Total length	200 mm.
Head	28 „
Width of head	21 „
Body	60 „
Fore-limb	31 „
Hind-limb	42 „
Tail	112 „

Locality:—Endeavour River, Queensland. The genus has hitherto only been met with in India and in New Zealand. The present locality helps to bridge over the interval.

We are indebted to Professor Spencer and Mr. C. French, F.L.S., for the opportunity of naming this species.

The type specimen is lodged in the National Museum, Melbourne.

Art. XVI.—*A New Genus and a New Species of Fish from the Mesozoic Rocks of Victoria.*

By T. S. HALL, M.A.,

Demonstrator and Assistant Lecturer in Biology in the University of Melbourne.

(With Plate XIV.)

[Read 16th November, 1899].

The fish dealt with in this communication have been in my hands for some time, and as no fresh material which would shed additional light on their structure is available, I have thought it better to treat what I have, rather than let the interesting fact of the presence of fish in our mesozoic rocks remain longer unrecorded.

Psilichthys, gen. nov.

Body long, slender. Scales absent except on the upper caudal lobe, where they are thick and rhomboidal. Caudal forked. Dorsal partly over anal and partly over the space between the anal and the ventrals. Fulcral scales large and thick; present on both dorsal and caudal. The name refers to the absence of scales on the body generally.

Psilichthys selwyni, sp. nov.

The posterior end only of the fish has been preserved, and shows the tail, part of the anal fin and the origin of the dorsal.

The body is narrow and elongate, the notochord is persistent, and its sheath is not ossified. The neural arches and spines are well developed, and towards the posterior end of the body are inclined at a very low angle to the notochord. The haemal arches and spines are similar to the neural, but the anterior ones are forked at their inner ends. Ribs are absent. The axonosts of the dorsal fin are twice as numerous as the obliquely inclined neural spines, which they do not seem to meet, and they are broadened or, in a few cases, forked at their inner ends. Forking

also occurs at their distal ends. For the most part they are shown merely as grooves in the matrix, but in one instance a hollow cylinder of bone is preserved, showing them to have been fairly well ossified. The baseosts are also ossified, but their relation to the axonosts cannot be clearly made out, owing to the presence of matrix. The supports of the anal, whether axonosts or baseosts is, from the nature of the specimen, uncertain, are also covered with a layer of bone.

The rays of all the fins are jointed, and as shown in the axial line of the tail are branched repeatedly. This branching is not seen elsewhere in the tail, so that very little of the caudal seems missing in the mid line, or in other words the tail is deeply cleft. At first sight the neural spines in the caudal region appear to have the supports of the fulcral scales of the upper edge of the caudal fitted directly on to them, but a thin raised line of ferruginous material cutting across most of them at the same level may perhaps mark a division of the bones, and indicate that the fulcral scales rest not directly on the neural spines, but on a more distal series. There are no scales on the body except on the upper caudal lobe where they are lozenge-shaped on the upperside, and oat-shaped on the lower. Their substance is thick and externally they are doubtfully smooth or very finely longitudinally grooved. The upper border of the caudal is furnished with a single row of large fulcral scales. Smaller fulcral scales are also indicated in front of the dorsal. As the front margins of the other fins are absent, their presence elsewhere is uncertain.

Length from posterior end (broken) of the notochord to the anterior edge of the origin of the dorsal is about 260 mm. Dorso-ventral diameter of the pedicel of the tail about 45 mm., and of the body at the middle of the dorsal fin 70 or 80 mm. The lozenge-shaped scales on the tail measure 5 by 2·5 mm., and the oat-shaped scales 11 by 3 mm.

The specific name is a tribute to Dr. A. R. C. Selwyn, who first geologically examined the district whence the specimen came.

Locality.—Carrapook (Muntham), county of Dundas, Western Victoria. From a tank sunk by Mr. Stock at his house, and forwarded by Mr. J. S. McPherson.

The exact position of the specimen in the zoological series, owing to the imperfect nature of the remains, is somewhat difficult to fix. There seem to be only two families which need to be taken into consideration as affording a possible resting place for our specimen, namely Palaeoniscidae and Chondrosteidae.

In the latter family only one genus, Chondrosteus, is at all well known, and from this our specimen differs in three particulars, namely, it has fulcrals on the dorsal, the dorsal is partly over the anal, and the neural arches are more completely ossified than in Chondrosteus.[1]

These characters might perhaps be regarded as merely generic, and as our fish is naked except on the upper caudal lobe, where thick rhombic scales occur, is devoid of ribs, and agrees in general build with Chondrosteus, it may possibly find its resting place in the same family.

As regards its relationship with the Palaeoniscidae we again find no characters as laid down by Smith Woodward[2] for this family which would prevent its inclusion in it. When, however, we come to its generic position there is no place into which it will fit. Comparing it with our Australian genus Coccolepis, there is the difference in squamation of the body and in the presence of the large fulcral scales both on dorsal and caudal, as well as the difference in the position of the dorsal which forbid their close association.

Leptolepis, Agassiz, 1832.

Leptolepis crassicauda, n.sp.

Distinguishable from the other described Australian species of the genus by the great comparative width of the pedicel of the tail which is one half of that of the body at the front end of the dorsal. The position of the fins is also somewhat different, the dorsal arising slightly in front of the ventrals and not behind them; while the anal arises a little behind the mid-point between the posterior end of the ventral and the caudal. The observable characters agree closely with those of the genus as detailed by

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1 A. Smith Woodward, Cat. Fossil Fishes in Brit. Mus., pt. iii., p. 27, pl. i., f. 4.

2 *L. cit.*, Part II., p. 426.

Mr. A. Smith Woodward,[1] though the head and fins, with exception of the caudal, are wanting. The vertebral column not fully ossified. The ribs are stout and reach nearly to ventral border, but their mode of attachment to the verte column is not clear. The neural spines in a line with anterior edge of the anal are stout and clearly united with neural arches, which in their turn fuse with the centra. front of this point they are indistinct. The haemal arches spines are also well developed in the caudal region and bro expanded at their inner ends. There are no fulcral scales the rays of the caudal, which is the only fin preserved, jointed and finely branched. The rudimentary caudal shown in Smith Woodward's figures of the Talbragar fish clearly visible in our specimen. The pelvic bones are lam and broadened at their inner ends. The posterior end of vertebral column is bent slightly upwards and there are hypurals such as occur in the Teleostea. The body was ap ently covered with very delicate cycloidal scales, the impre of their internal faces being sculptured with extremely waved, concentric lines. No trace of the substance of the sc is preserved, so they were probably not "ganoid."

Length from anterior edge of origin of dorsal to posterior of vertebral column 40 mm. Breadth at origin of dorsal 25 m Breadth of pedicel of tail 14 mm.

Locality.—Casterton. From the railway cutting on the bank of the Glenelg. Found by Rev. J. H. MacFarlane, presented by him to the Ballarat School of Mines.

The only other animal remains recorded from the meso area whence these fossils come is a Unio to which Sir F. McCoy gave the manuscript name of *U. dacombi.*

Sir F. McCoy records *Taeniopteris daintreei (Angiopteridium spathulatum)* from Murundal on the Wannon, and Mr. Dennant mentions an Otozamites as having been identified for him by Mr. R. Etheridge from tufaceous rocks at Mount Koroite.

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[1] The Fossil Fishes of the Talbragar Beds (Jurassic?), Mem. Geol. Surv. N. S. Wales, Palaeontology No. 9, 1895, p. 19.

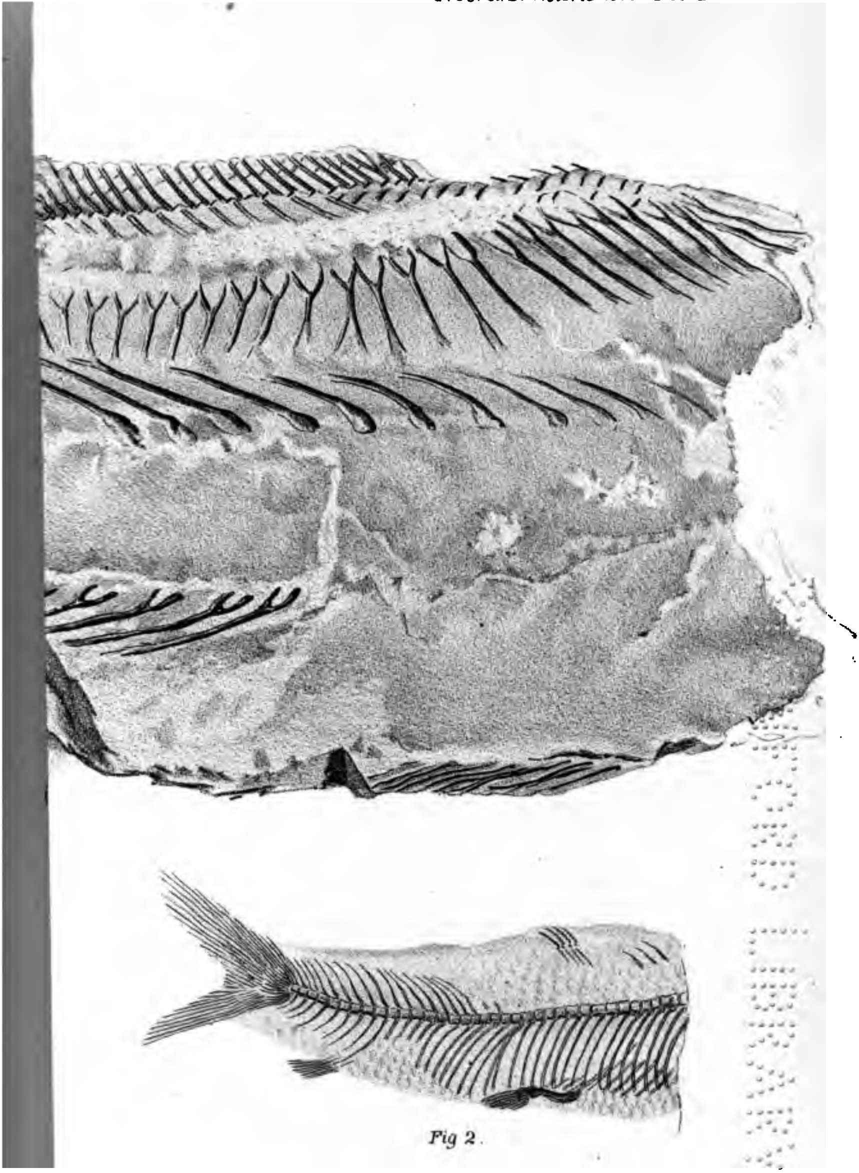

Fig 2.

R Wendel del et lith.

With the specimen of Psilicthys there were forwarded from the same locality a Taeniopteris, and a Baiera, both, however, specifically indeterminate. Mr. W. S. Dun has supplied some notes on these, which appear in a later paper in the present volume.

So far the evidence is not sufficient to enable us to correlate the beds definitely with others, or to say more than that they are either of Jurassic or Triassic age.

DESCRIPTION OF PLATE XIV.

Fig. 1—Psilichthys selwyni, nat. size.
Fig. 2—Leptolepis crassicauda, nat. size.

Art. XVII.—*Niphargus pulchellus, a New Victorian Blind Amphipod.*

By O. A. SAYCE.

(With Plates XV., XVI.)

[Read 16th November, 1899.]

In a previous paper published in this journal (present volume, p. 122), I described and figured a blind Isopod, *Phreatoicoides gracilis*, from a fresh-water runnel in Gippsland. In a small pool, within a few yards from this runnel, I collected three specimens of a blind Amphipod, which, upon examination I find to possess characters in common with the genus *Niphargus* of Schiödte. This genus is described by Bate and Westwood,[1] with which the present species agrees in all respects except in the terminal uropoda, which do not possess a rudimentary inner ramus. This slight modification of structure is, however, a minor feature, and I have, therefore, considered it a *Niphargus*.

The *Niphargi* are of particular interest, and live generally in closed pump-wells in England, and many parts of Europe, where some species inhabit lakes. Their nearest congener is said by Bate and Westwood to be *Eriopus*, from the deep sea off Bohusia.

In 1892 Mr. G. M. Thomson described two forms from Tasmania, which with some hesitation he placed in the genus *Niphargus*, viz., *N. mortoni* and *N. montanus*.[2] Of the two, the latter species, from the summit of Mount Wellington (4,000ft.), is the nearest to the normal type. The present species is well characterised, and differs from *N. montanus* by the more slender body, narrower side-plates, the want of eyes, the elongated last pereiopoda, and the greatly extended, unibranched, jointed, terminal uropoda; these are longer than in any figures of amphipods that I have seen, and bear, on microscopical evidence, numerous specialized sensory setæ.

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1 A History of British Sessile-eyed Crustacea, by C. Spence Bate, F.R.S., F.L.S., and J. O. Westwood, M.A., F.L.S., Vol. I., p. 311.

2 Notes on Tasmanian Crustacea, with Descriptions of New Species, by G. M. Thomson, F.L.S. Proc. Royal Soc. Tasmania, 1892, p. 68.

Niphargus pulchellus, n. sp.

Specific diagnosis.—Body long, slender. Eyes wanting. Coxæ of anterior four segments of pereion slightly less in depth than their respective segments, those of the three succeeding ones being short. Gnathopoda having the propoda small, subquadrate, narrowest proximally; second slightly the longer; palmæ transverse, margin straight, spinuous. Last pair of pereiopoda with propodos, and carpus much longer than those of the anterior ones. First three segments of pleon subequal, inferior margins rounded, posterior angles bearing two spinules. First and second uropoda short, first longer than second; similar in form, peduncle longer than rami. Terminal uropoda very long, jointed, inner ramus wanting. Telson cleft half way to the base.

Colour—Snow white.

Length—6 to 7 mm.

Habitat—Fresh-water pool, Thorpdale, Gippsland.

Detailed Description.

The following description is taken from a specimen of 6·5 mm. in length. The largest, amongst three collected, measured 7 mm. Each was similar in form, even in the proportional length of the terminal uropods, which in this genus are said by Schiödte to be variable in length according to sex, that of the male being the longer.

Body (Plate XV., Fig. 1).—The body is slender, with a few short setæ situated upon it. The coxæ of the first four segments of the pereion are almost as deep as their respective segments, those of the following three being narrow, and each is fringed by a few short setæ. The anterior segment of the pleon is produced downward to the level of the inferior margin of the coxa of the preceding segment, and the succeeding ones are subequal. The antero- and postero-inferior angles of the anterior three segments of the pleon are evenly rounded, and each have two spines pointing hindward on the posterior angle. There is no appearance of any eyes or pigment.

Upper Antennæ.—The upper antennæ are about two-thirds the length of the body. The first joint of the peduncle is long, with the upper margin convex, and lower straight, the second joint

carpus is sub-equal, and the outer margin convex with a few long setæ distally, the inner margin convex, and fringed by long, fine, curved setæ, and also a few spinules distally. The propodos is narrow, slightly shorter than the carpus, and curving inwards; the outer and inner margins bear a few long, stiff setæ, and on the upper surface, at two places equi-distant from the proximal and distal margins, there is a tuft of about three spinules. The dactylos is shorter than the propodos, it is somewhat curved, acute, and terminating in two long curved spinules, and a few shorter ones on the inner distal extremity.

Gnathopoda (Fig. 9).—The gnathopoda are almost identical in form and in the arrangement of the setæ; the second is, however, somewhat the longest. I shall only describe the first, the figure will sufficiently delineate the slight difference of the second. The side plate (coxa) is not so deep as broad, the ventral margin is straight, with the angles rounded, and bearing a few scattered setæ. The basos is slightly more than twice as long as broad, with the anterior margin straight, and having a bunch of long stiff setæ proximally; the posterior margin is convex, and bears two or three very long scattered setæ, and from its postero-distal angle a tuft of long setæ; on the inner side, proximally, and toward the anterior margin there is a tuft of long setæ.

The ischios is short, sub-rectangular, and from its hinder distal angle there is a tuft of long setæ. The meros is of similar length to the ischios, triangular in outline, with a tuft of setæ on the hinder distal angle. The carpus is somewhat longer and wider than the meros, and articulates obliquely with it; it is ovoidal in outline, and the posterior margin is deeply grooved longitudinally, so that the propodos can, in part, be flexed within it. About midway along the anterior margin there is a tuft of two or three setæ, and a similar one close to the distal extremity; close to the hinder margin there is a single series of long pointed spinules, which is interrupted in two places by narrow spaces. The propodos is nearly square in outline, but narrowest proximally. At the antero-distal angle there is a tuft of stout setæ, and midway along the hinder margin there is a tuft of long fine setæ. The palm is transverse, and the posterior end slightly produced and rounded; the margins are fringed by short stout spines. On the outer surface of the joint, near the postero-distal

angle, there is a row of about three long setæ, and another row of about four similar setæ, near the front margin, about midway between the proximal and distal ends. The dactylos is long, slightly curved, margins entire, and the extremity acute.

Pereiopoda (Fig. 10).—The first pereipod is slender and about one-fourth longer than the second gnathopod. The basos is narrowly oblong, with two or these very long setæ on the hinder margin. The ischios is subrectangular, with a tuft of setæ at the postero-distal angle. The meros is oblong and slightly produced at the antero-distal angle, and possessing a few setæ on the anterior and posterior margins, and also tufts at the antero- and postero-distal angles. The carpus is somewhat shorter than the meros, with margins nearly straight, and having a tuft of setæ on the antero-distal angle, and a few scattered setæ on the hinder margin. The propodos is slightly longer than the carpus, but narrower, and the margins straight; on the antero-distal angle there is a tuft of long setæ, and the hinder margin is clothed with five short spinules. The dactylos is very slightly curved, acute, and with a fine tooth distally.

The second pereiopod is similar in all respects to the first.

The third pereiopod is subequal to the first and second, but it is reversed in its manner of articulation with the body, and is rather stouter.

The fourth pereiopod (Fig. 11, inside view), is longer and stouter than the third. The propodos has six short spines, arranged in transverse pairs, at equal distances along the anterior margin.

The fifth pereiopod is much longer than the fourth, due to the extra length of the carpus and propodos; the other joints are of similar length to the fourth pereiopod, and also of similar form except the dactylos, which is in the fifth almost straight, but, as in the other pereiopods, it has a fine lateral tooth distally.

Pleopoda (Fig. 12).—The pleopoda are of the usual shape, the anterior pair being somewhat the longer. Distally, on the inner surface of the peduncle, there are two "coupling spines" (12*a*), and on the first joint of the inner ramus there are four "cleft-spines" (12*b*), in two longitudinally disposed pairs.

First Uropoda (Fig. 1).—The first uropoda extend beyond the extremity of the second uropoda. The peduncle is twice the length of the rami, and bears three spines on the dorsal surface, two being situated on the outer margin, and one distally on the inner margin. The rami are similar to each other, each curving very slightly upwards, with bluntly rounded ends, bearing three short spinules and one long one, all of which point directly upwards; along the upper margin of each there are also two short spinules.

Second Uropoda.—The second uropoda are only half the length of the first uropoda, but are subequal in form.

Third Uropoda.—The third uropoda are remarkably long, equalling in length that of the entire pleon. They are carried normally in a vertical position, and doubtless possess a special sensory function, for I have determined thereon, what are evidently from their structure, sensory hairs (Fig. 13). They are very similar in appearance under high magnification to those I noted on the first antennæ of *Phreatoicoides gracilis*, and described under "C" form.[1] The peduncle is very short and robust, the anterior margin concave, and the hinder margin evenly convex, with a tuft of six or more stiff setæ on its distal extremity which point upwards and hindwards. There is only one ramus, and no appearance of a second one remaining. This single ramus is two-jointed, the proximal one being slightly the longest as well as also being the stoutest; the hinder margin is straight; the posterior margin also is straight, but narrows both at its proximal and distal attachments. On the distal margin there is a circlet of sensory setæ similar in appearance to Fig. 13, and in two places equi-distant from the proximal and distal ends there are, on the hinder margin, two spinules pointing hindwards, and near to each of these, on the outer surface, there are two or three spinules pointing hindwards, and also in addition there are two or three fine setæ on the hinder margin near to the attachment with the peduncle. The second joint has the margins nearly straight, and extremity bluntly pointed, from which springs a circlet of long fine sensory setæ similar to Fig. 13. The hinder margin has two spinules disposed as in the first

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1 Antea, p. 128.

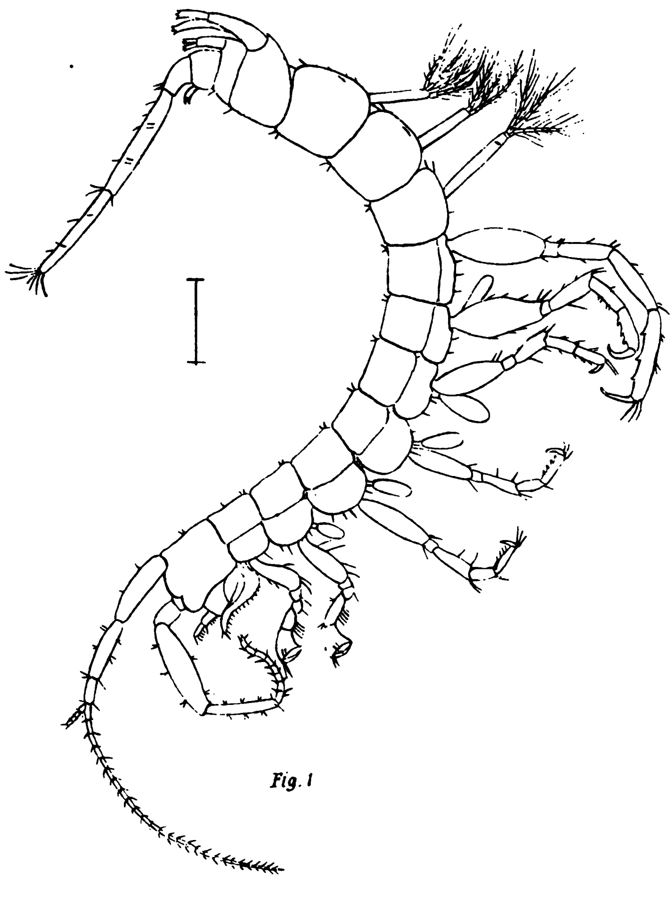

Fig. 1

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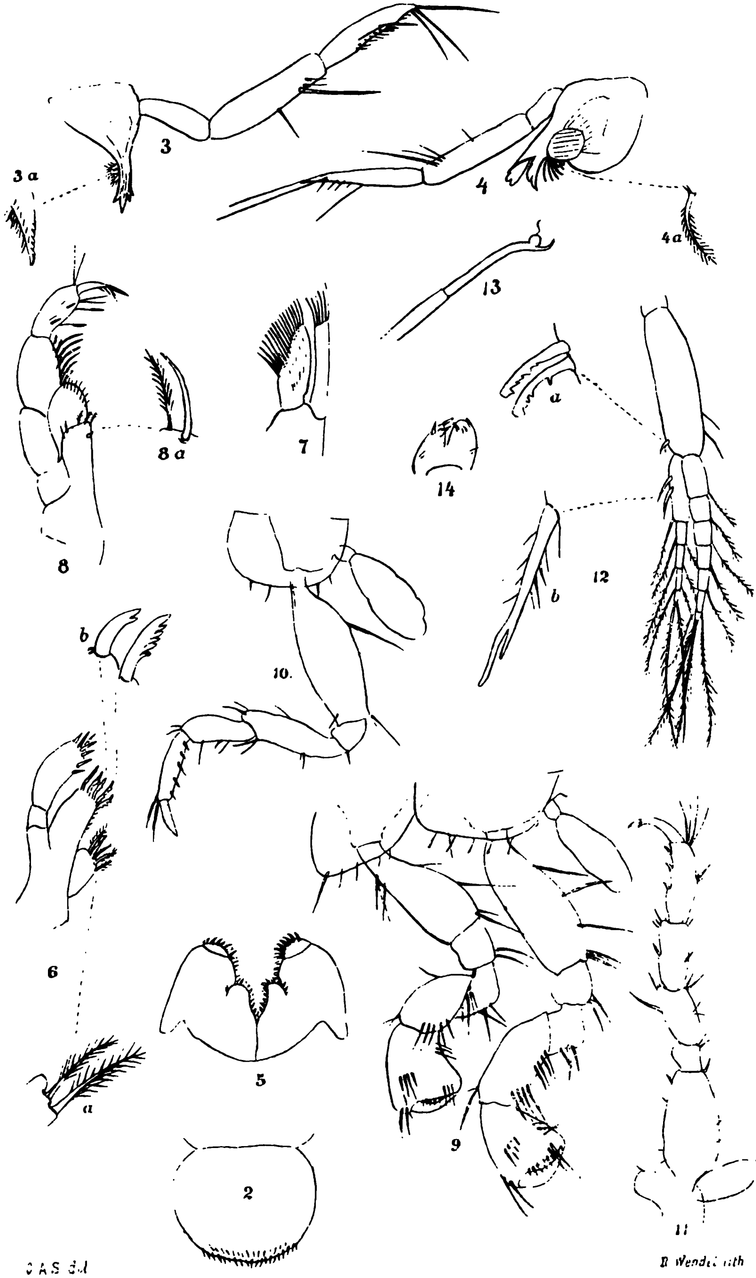

J A S del

B Wendel lith

joint, also two spinules near these on the outer surface, which point hindward.

Telson (Fig. 14).—The telson is cleft half-way to the base, and is slightly shorter than the peduncles of the terminal uropoda. It has distally on the upper surface of each piece three long and one short stout and slightly curved spines, and also on the same surface, but proximally, there are two or three fine spinules near the outer margin.

DESCRIPTION OF PLATES.

Plates XV. and XVI.

Fig. 1. Side view of *Niphargus pulchellus* × 15.
,, 2. Upper Lip × 66.
,, 3. Right Mandible, outside view, × 66. (*a*) Spine from spine row × 190.
,, 4. Left Mandible, inside view, × 66. (*a*) Plumose Spine from corresponding position to 3*a* × 190.
,, 5. Lower Lip × 66.
,, 6. First Maxilla × 66. (*a*) Plumose spine from inner lobe × 190. (*b*) Pectinated spine from outer lobe × 190.
,, 7. Second Maxilla × 66.
,, 8. Maxilliped of left side, from above × 66. (*a*) Spines from summit of inner lobe × 190.
,, 9. First and Second Gnathopoda × 30.
,, 10. First Pereiopod × 35.
,, 11. Fourth Pereiopod, inside view, × 23.
,, 12. First Pleopod × 45. (*a*) Two "Coupling spines" × 300. (*b*) "Cleft spine" × 300.
,, 13. Extremity of a sensory seta from terminal Uropod, drawn under oil im. lens of N.A. 1.30. Abbé Condenser. $\frac{3}{4}$ Cone.
,, 14. Telson × 45.

Art. XVIII.—*Note on Two Fossil Plants from Dundas.*

By W. S. DUN.

[Read 14th December, 1899.]

Mr. T. S. Hall has been kind enough to allow me to examine two specimens of *Tæniopteris* and *Baiera*, occurring in an ochreous, arkose sandstone at Dundas. Their state of preservation, unfortunately, is not so good as to enable them to be determined specifically, but there is sufficient evidence to show that they differ from anything already recorded from Victoria.

Tæniopteris, sp. ind.

Length of frond 91 mm.; stalk as preserved, 29 mm. long; the breadth in the widest part would be about 22 mm. Apex obtuse. Venation not seen except in the apical portion, close, simple, inclined to the midrib at about 45°. Midrib well developed.

This species falls within the section of Tæniopterids classed as *Oleandridium* in which the fronds are simple, elongate-lanceolate; the venation is more inclined to the midrib and simple than in the other main section, *Angiopteridium*. For comparison with Australian forms we must take into consideration (1) *Oleandridium lentriculiforme*, Eth. fil.,[1] (2) *Tæniopteris etheridgei*, Shirley,[2] and (3) *O. lentriculariforme*, Eth. fil. (Shirley).[3] From (1) the Dundas specimen differs in having a longer and narrower frond and more acute venation. The apical portion does not show bifurcation of venation as in *O. lentriculiforme*, Shirley, which is probably closely allied to the same author's *T. etheridgei*. (Both Mr. Shirley's species differ, as figured, from the New South Wales species in that the venation of the latter is to all intents and purposes simple).

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1 Records Geol. Survey, N. S. Wales, 1894, iv., p. 49, t. 8.
2 Add. Foss. Flor. Queensland, 1898, t. 9, f. 1.
3 *Op. cit.*, t. 7, f. 3.

The general form of the frond of *Oleandridium vittatum*, Brongniart, as figured by Feistmantel[1] from the Indian Upper Gondwanas, agrees closely with that of the Dundas specimen, but the venation is less inclined and more widely spaced. Zeiller[2] has figured a leaf from Sang-Sen which he refers to *Tæniopteris McClellandi*, Oldham and Morris, which in closeness of venation approaches our specimen. In this connection it may be pointed out that Zeiller's figure shows an almost entire absence of bifurcation of venation, whereas in the original figures that condition is much more frequent.[3]

It is, in my opinion, very likely that when better preserved specimens are found this will prove to differ specifically from the N. S. Wales and Queensland forms, but till then nothing definite can be said.

Baiera, sp.

The specimen is less definite than the *Oleandridium*, and it is impossible to arrive at the dimensions of the perfect leaf. The distal portions, up to 55 mm. in length represent six of the leaf divisions. It does not appear to have been so dichotomous as either *B. ginkoides* or *B. ipsviciensis*, Shirley, which also appear to have been finer veined.[4] It also is widely separated from Tenison Wood's *Jeanpaulia bidens*[5] (*Ginkgo bidens*, Shirley). The Dundas specimen may be compared with Feistmantel's *B. schenki*,[6] from Indwe, Upper Karoo formation. In this form the leaf divisions are very much longer and narrower than those of our specimens appear to be. There can, I think, be little doubt that this species is distinct from any Australian form hitherto described, though it is impossible to draw up a satisfactory diagnosis from the limited material.

Both specimens were found associated with *Psilichthys selwyni*, T. S. Hall, at Carapook (Muntham), County of Dundas, Victoria.

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1 Pal. Ind., Foss. Flor. Gondwana Syst., ii., p. 5, t. 1, figs. 1-3; t. 2, figs. 1-5; t. 12, figs. 1, 1*a*.

2 Ann. d. Mines, 1888, pp. 6-7, t. 10, f. 5. (separate copy).

3 Pal. Ind., Foss. Flor. Gondwana Syst., I., t. 23.

4 Shirley, *op. cit.*, t. 3, figs. 1, 2.

5 Proc. Linn. Soc. N. S. Wales, 1883, viii., t. 4, f. 3.

6 Abhandl. K. bohm. Gesell. Wissen., 1883, vii., t. 3, figs. 1, 2, 6.

ART. XIX.—*Further Descriptions of the Tertiary Polyzoa of Victoria.—Part III.*

BY C. M. MAPLESTONE.

(With Plates XVII. and XVIII.).

[Read 14th December, 1899.]

Bigemellaria pedunculata, McG. (Pl. XVII., Fig. 1).

Dr. MacGillivray states in his Monograph that none of his specimens of this species showed the upper termination of the zoarium. I have found a specimen showing it, but the lower portion is broken off.

The zoarium terminates with two zoœcia, between which is a triangular area; a ridge on each side extends from the upper part of the thyrostome of one zoœcium to that of the other, just below which, in the median line, is a small circular opening indicating that the zoarium, when perfect, consisted of internodes as in *Cellaria*, and that it was branched dichotomously.

Liriozoa lævigata, Waters, sp. (Pl. XVII., Fig. 2).

I have found many specimens of this species of which Dr. MacGillivray found only two, and while his figure is much better than that of Mr. Waters in Q.J.G.S., 1882, pl xii., it does not show any perforations in the wall of the zoœcia nor does he mention them in his description. Mr. Waters describes the zoœcia as "coarsely punctate," but also says "dorsal and anterior surface smooth." Some of my specimens are perfectly smooth, without any perforations and agree with Dr. MacGillivray's description and figures. Others have a few scattered perforations (or rather minute circular depressions, as they do not extend far down in the cell wall) over the zoœcia with two rows of perforations on the back of the central zoœcium, but I have met with none that I would call "coarsely punctate."

Calwellia otwayensis, n. sp. (Pl. XVII., Fig. 3).

Zoarium phytoid, dichotomously branching. Zoœcia infundibuliform, in pairs, back to back, each pair facing at right angles to the adjoining pairs. Thyrostome horizontal, semi-elliptical; peristome irregularly projecting outwards; occasionally a small oval sessile avicularium on the inner edge of the peristome having a triangular mandibular cavity separated by a bar from a small semi-circular area; a few pores on the inner edge of the zoœcia, also on the tubular prolongation.

Locality.—Aire River, Cape Otway. (Messrs. Hall and Pritchard).

This genus has not been found fossil before.

Fig. 3*b* is drawn from a fragment and shows the upper part of two zoœcia seen from above; there are two perforations, indicating the position of avicularia.

Fig. 3*c* shows a perfect avicularium with the cross-bar.

Cellularia triangulata, n. sp. (Pl. XVII., Fig. 4).

Zoarium continuous. Zoœcia biserial, somewhat turbinate. Aperture oval, occupying about two-thirds of the area of the zoœcium; margin thickened; a sessile avicularium below the aperture with an acute mandible opening upwards and inwards; there are indications of a marginal spine on the exterior side of the zoœcia near the top. Dorsal surface of the zoarium very smooth, elevated longitudinally into a prominent ridge, making the zoarium triangular in section; zoœcia totally undefined.

Locality.—Bairnsdale. (J. Dennant).

A single specimen. I am doubtful whether this should be referred to *Cellularia* or *Menipea*, as the species of the former genus are without avicularia as a rule, and those of the latter have marginal avicularia which this species has not, but, I think, considering the zoarial character it had better be placed in *Cellularia* at present.

Scrupocellaria glomerata, n. sp. (Pl. XVII., Fig. 5).

Zoœcia quadri-serial elongate, marginal ones somewhat pyriform in front; aperture elongate with a broad granular margin sloping inwards, sometimes slightly constricted near the upper part; a

sessile avicularium, with a small subcircular mandibular area, below the aperture. Dorsal surface shows the backs of only two rows of zoœcia (the marginal), which are so much broader than the front that they meet in the centre, the central zoœcia must consequently be smaller than the marginal and heaped up; a vibraculum at the base of each (marginal) zœcium.

Locality.—Mitchell River. (J. Dennant). A single specimen only.

Amastigia acuminata, n. sp. (Pl. XVII., Fig. 6).

Zoœcia biserial, alternate; outer angle produced into a long conical spine; aperture oval, almost covered with a pedunculate, broadly spatulate scutum. The dorsal surface has a narrow median ridge, the upper and lower boundaries of the zoœcia are defined by a linear depression; an avicularium, with an acute mandible pointing downwards on each zoœcium.

Locality.—Moorabool. (T. S. Hall). A single specimen.

Caberea morningtoniensis, n. sp. (Pl. XVII., Fig. 7).

Zoœcia tri- or quadri-serial, elongate; aperture occupying a little more than half the surface, elongated, oval, slightly constricted near the upper part; margin granulated; two spines on each side above the constriction; two sessile avicularia below the aperture, and a small sessile avicularium on the upper and outer angle of the marginal zoœcia. Oœcia mitriform, convex, smooth; a sessile avicularium with long triangular mandible on each side above.

Locality.—Mornington. (T. S. Hall).

This differs from *C. grandis* in that it has two spines on each side of the marginal and central zoœcia, that species having only one on each side of the central zoœcia, and two on the internal, and one on the external angle of the marginal zoœcia; the avicularia are larger, especially those above the oœcia, and the oœcia have no thickened rim.

Menipea retroversa, n. sp. (Pl. XVII., Fig. 8).

Zoarium continuous, dichotomously branched. Zoœcia biserial, elongate, slightly narrowed below; aperture oval, occupying about two-thirds of front; a small round avicu-

larium below aperture; lateral avicularia facing backwards with mandible pointing upwards. Dorsal surface smooth; zoœcia distinct, a narrow ridge dividing them longitudinally.

Locality.—Spring Creek. (T. S. Hall).

A single specimen. It is almost diaphanous and is partially obscured by small fragments of matrix. The lateral avicularia are peculiar in that they face backwards and can hardly be detected on the front view; their position, I think, precludes the idea of their being vibracula, therefore I refer the species to *Menipea.*

Menipea bicellata, n. sp. (Pl. XVII., Fig. 9).

Zoœcia in internodes of two only, broad above, attenuated below; aperture sub-circular with broad plate slanting inwards on lower edge; four spines on upper margin; a small avicularium below the lower lip, sometimes absent; no lateral avicularia.

Locality.—Moorabool and Muddy Creek. (T. S. Hall).

Menipea biaviculata, n. sp. (Pl. XVII., Fig. 10).

Zoarium articulated (?). Zoœcia biserial, elongate; aperture occupying two-thirds of the area; margin granular; a small lateral marginal avicularium on the upper and outer angle of the zoœcia; a large avicularium on the margin near the base of the zoœcia on one side of the zoarium only. Zoœcia defined on the dorsal surface.

Locality.—Aire River, Cape Otway. (Messrs. Hall and Pritchard).

I refer this to *Menipea,* but the large marginal avicularia on one of the two series of zoœcia are very peculiar and more noticeable on the dorsal aspect. The zoarium is probably articulated as the structure of the upper part plainly indicates such, especially on the left hand side (in the figure).

Cellaria contigua, McG. (Pl. XVII., Fig. 11).

In some material from Muddy Creek I have found a specimen of this species in which there is an avicularian mandible *in situ.* As will be seen it is long, acute, slightly oblique, and extends beyond the avicularian chamber, of which one, without the mandible, from the same specimen, is drawn on the same scale.

Locality.—Muddy Creek. (J. Dennant).

This is a most interesting specimen, as I am not aware that an avicularian mandible has ever been found preserved in fossils; the locality, some sixty miles from the sea, precludes the idea of its being a recent specimen, and besides it is not a recent species.

Cellaria ovicellosa, Stoliczka. (Pl. XVIII., Fig. 12).

I give a figure of this species as Stoliczka does not notice the margins of the zoœcia, he only shows the raised area with smooth interspaces and speaks of the zoœcia as "*cellulis magnis distantibus;*" his specimen was probably much worn, as the "natural size" figure shows it to have been a very small fragment. The margins are linear ridges but slightly elevated above the surface, and show the zoœcia to be diamond shaped, or rather oval with pointed distal and proximal extremities.

The species which Mr. Waters identified with this has been renamed by Dr. MacGillivray, *C. laticella*, and the figures given by both all show the raised portion of the zoœcia as more or less pointed below, whereas in Stoliczka's figure of *C. ovicellosa* the proximal end has the same curve as the upper or distal part and it is consequently not oval, but elliptical as in the specimen I have figured.

Cellaria enormis, n. sp. (Pl. XVIII., Fig. 13).

Zoarium very robust, clavate. Zoœcia very large, hexagonal with upper and lower ends truncated horizontally; margins raised; thyrostome arched above, straight below with two denticles on lower margin; avicularian cells larger and broader than the others, with the upper half of the margin curved; avicularian opening large, arched above, slightly concave below and a raised margin round it.

Locality.—Balcombe Bay, Mornington. (T. S. Hall).

This species is remarkable for the large size of the zoarium and zoœcia and for the very large avicularia.

Cellaria crassimarginata, n. sp. (Pl. XVIII, Fig. 14).

Zoarium robust, oval in section, upper portion raised into two prominences from each of which an internode arises. Zoœcia

elongated, diamond shaped with slightly truncated distal and proximal extremities; margins raised; thyrostome subtriangular with a thickened peristome, lower lip incurved.

Locality.—Orphanage Hill, Geelong. (T. S. Hall).

This is a very peculiar species as the upper portion of the zoarium diverges into two elevations to each of which an internode is apparently attached and the peristome is thickened and raised above the surface of the zoœcia. The two upper apertures may be avicularia, as they are not of the same shape as the thyrostome.

Cellaria depressa, n. sp. (Pl. XVIII., Fig. 15).

Zoarium very robust. Zoœcia diamond shaped (very slightly truncated horizontally) with linear raised margins, within which the surface of the zoœcia is raised as a broad slightly convex ridge round the sides; middle of the zoœcia depressed; whole surface granulated; thyrostome near the distal end, arched above, straight below, with two denticles in lower lip.

Locality.—Shelford. (T. S. Hall).

In the size of the zoarium and zoœcia this is very similar to *C. crassimarginata*, but otherwise quite distinct.

Cellaria tumida, n. sp. (Pl. XVIII., Fig. 16).

Zoarium long and slender. Zœcia irregularly hexagonal, very tumid; margins invisible, deeply sunk; thyrostome in the centre of the zoœcia, more or less crescentic, much depressed.

Locality.—Mitchell River. (J. Dennant).

This is a very peculiar species, the tumid or swollen appearance of the zoœcia being quite unlike any other; the portion of the internode found is very long in proportion to its diameter.

Bicellaria elongata, n. sp. (Pl. XVIII, Fig. 17).

Zoœcia elongate, turbinate, much produced below; aperture ovoid, occupying about a third of the area; two spines at outer angles. Dorsal surface smooth, ventricose above; zoœcia divided by a narrow longitudinal ridge.

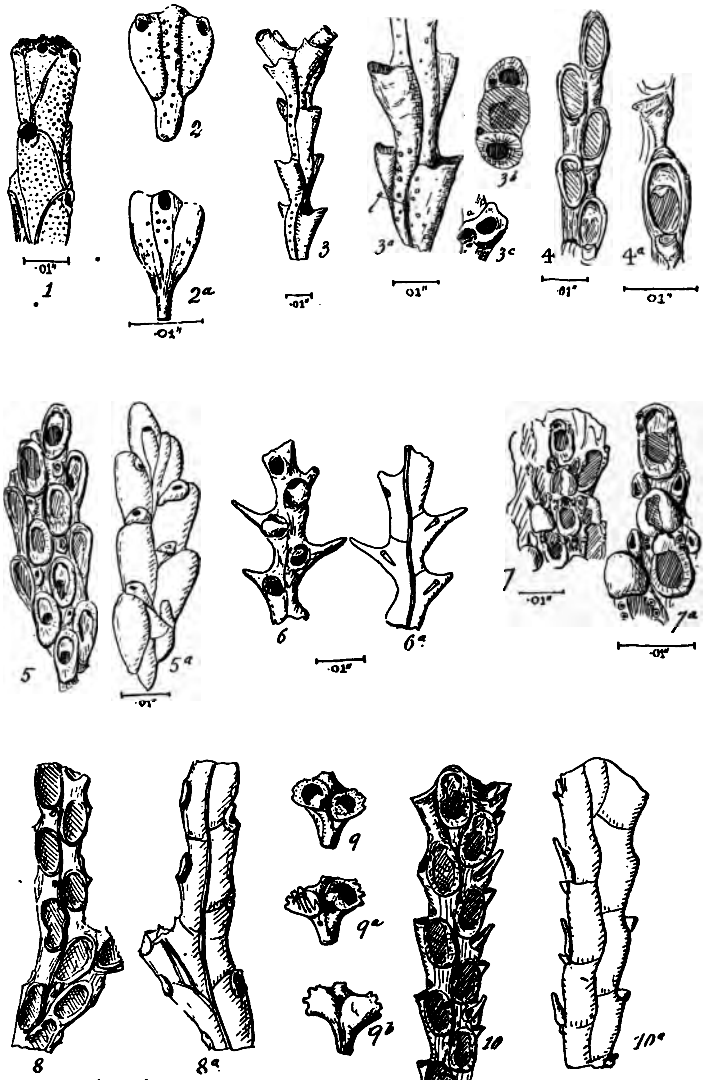
Locality.—Mornington. (T. S. Hall).

The specimen is small, consisting of three zoœcia only, but is in very good preservation save that the spines are broken off. The dorsal surface of the ventricose portion of the topmost zoœcium is concave with a slightly thickened margin, part of which is seen through the aperture in the front view; this I think shows that it once bore an oœcium, which has been broken off. The zoœcia are more closely connected than those of the recent species of *Bicellaria*, but I think there is no doubt it belongs to that genus.

EXPLANATION OF FIGURES.

Plates XVII. and XVIII.

Fig. 1. Bigemellaria pedunculata.
„ 2. Liriozoa lævigata (front aspect).
„ 2*a*. Liriozoa lævigata (dorsal aspect).
„ 3. Calwellia otwayensis.
„ 3*a*. Calwellia otwayensis (more highly magnified).
„ 3*b*. Calwellia otwayensis (upper part of two zoœcia seen from above).
„ 3*c*. Calwellia otwayensis (thyrostome and avicularium).
„ 4. Cellularia triangulata.
„ 4*a*. Cellularia triangulata (more highly magnified).
„ 5. Scrupocellaria glomerata.
„ 5*a*. Scrupocellaria glomerata (dorsal surface).
„ 6. Amastigia acuminata.
„ 6*a*. Amastigia acuminata (dorsal surface).
„ 7. Caberea morningtoniensis.
„ 7*a*. Caberea morningtoniensis (more highly magnified).
„ 8. Menipea retroversa.
„ 8*a*. Menipea retroversa (dorsal surface).
„ 9. Menipea bicellata.
„ 9*a*. Menipea bicellata.
„ 9*b*. Menipea bicellata (dorsal surface).
„ 10. Menipea biaviculata.
„ 10*a*. Menipea biaviculata (dorsal surface).
„ 11. Cellaria contigua (avicularian mandible).
„ 11*a*. Cellaria contigua (avicularian cell).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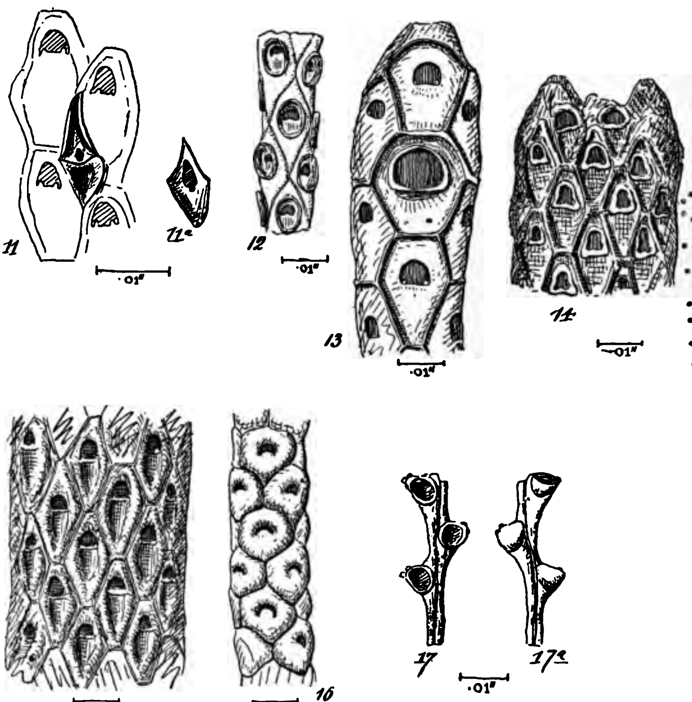
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Fig. 12. Cellaria ovicellosa.
„ 13. Cellaria enormis.
„ 14. Cellaria crassimarginata.
„ 15. Cellaria depressa.
„ 16. Cellaria tumida.
„ 17. Bicellaria elongata.
„ 17*a*. Bicellaria elongata (dorsal surface).

ART. XX.—*Catalogue of the Marine Shells of Victoria.*

PART III.

BY G. B. PRITCHARD AND J. H. GATLIFF.

[Read 12th October, 1899.]

In December, 1897, we contributed Part I. of the present catalogue, which included 83 species; and in December, 1898, Part II., which included 58 species; the present part includes 77 additional species, comprising the following families:—Pleurotomidæ, Conidæ, Strombidæ, Cypræidæ, Cassididæ, Naticidæ, Hipponycidæ, Capulidæ, Turritellidæ, and Vermetidæ. This brings the number of species we have already dealt with to 218.

Family PLEUROTOMIDÆ.

Genus Drillia, Gray, 1838.

DRILLIA HARPULARIA, Desmoulins.

Pleurotoma harpula, Valenciennes, m.s. (non Brocchi).

Pleurotoma harpula, Kiener. Icon. Coq. Viv., p. 58, pl. 18, f. 3.

Drillia harpularia, Desmoulins. Actes Soc. Linn. Bordeaux, vol. xii., p. 162.

1843. Pleurotoma harpularia, Reeve. Conch. Icon., vol. i., pl. 15, f. 124.

1884. Drillia harpularia, Tryon. Man. Conch., vol. vi., p. 193, pl. 14, f. 99.

1887. Pleurotoma (Crassispira) harpularia, Weinkauff. Conch. Cab. (ed. Küster) vol. iv., p. 97, No. 115, pl. 21, f. 2, *a*, *b*.

Hab.—Portland.

Obs.—This species has hitherto been somewhat rare amongst Victorian collections.

DRILLIA QUOYI, Desmoulins.

Pleurotoma monile, Valenciennes (non Brocchi). Icon. Coq. Viv., Mon. Pleurotoma, p. 52, pl. 15, f. 3.

1842. Pleurotoma quoyi, Desmoulins. Actes Soc. Linn. Bordeaux, p. 61.
1846. Pleurotoma quoyi, Reeve. Conch. Icon., vol. i., pl. 16, f. 137.
1876. Pleurotoma philipineri, T. Woods. P.R.S. Tas., p. 136.
1884. Surcula quoyi, Tryon. Man. Conch., vol. vi., p. 242, pl. 7, f. 95.
1884. Clavatula (Perrona) monile, Tryon. *Id.*, p. 232, pl. 7, f. 96.
1884. Pleurotoma philipineri, Tryon. *Id.*, p. 167, pl. 34, f. 82.
1886. Pleurotoma (Drillia) quoyi, Watson. Chall. Zool., vol. xv., p. 304.
1887. Pleurotoma (Surcula) quoyi, Weinkauff. Conch. Cab. (ed. Küster) p. 101, sp. 121, pl. 22, f. 2.
1896. Surcula quoyi, Sowerby. P. Mal. S. Lond., p. 24.

Hab.—Western Port (dredged 5 fathoms, C. J. Gabriel); Apollo Bay, and Warrnambool (G. B. P.).

DRILLIA BERAUDIANA, Crosse.

1863. Drillia beraudiana, Crosse. Jour. d. Conch., p. 88, pl. 1, f. 6.
1884. Drillia angasi, Tryon (non Crosse). Man. Conch., vol. vi., p. 187, pl. 9, f. 36.
1887. Pleurotoma (Crassispira) beraudiana, Weinkauff. Conch. Cab. (ed. Küster), p. 95, No. 113, pl. 20, f. 7, 9.

Hab.—Flinders; San Remo; dredged off Phillip Island, Western Port, in about 5 fathoms (C. J. Gabriel); Port Phillip; Puebla coast.

DRILLIA ÆMULA, Angas.

1877. Drillia æmula, Angas. P.Z.S. Lond., p. 36, pl. 5, f. 9.
1880. Drillia æmula, Hutton. Man. N.Z. Moll., p. 44.
1884. Drillia traillii, Tryon (non Hutton). Man. Conch., vol. vi., p. 206, pl. 12, f. 37.
1887. Pleurotoma (Drillia) æmula, Weinkauff. Conch. Cab. (ed. Küster), p. 221, No. 259, pl. 41, f. 9.

Hab.—Portland (Mrs. A. F. Kenyon), one specimen only obtained.

Obs.—The description of D. trailli, Hutton, Man. N.Z. Moll., p. 42, is a very brief one, but Tryon in the Manual of Conchology, vol. vi., p. 206, states it is the same as D. æmula, and on plate 34, fig. 90 he represents Hutton's species, which, however, differs materially in dimensions and in its sculpture, and on these facts we cannot accept it as being the same.

DRILLIA MINUTA, T. Woods.

1876. Drillia minuta, T. Woods. P.R.S. Tas., p. 8, No. 15.

1884. Drillia minuta, Tryon. Man. Conch., vol. vi., p. 210, pl. 34, f. 93.

Hab.—Western Port.

DRILLIA CRENULARIS, Lamarck.

1822. Pleurotoma crenularis, Lamarck. Anim. S. Vert., vol. vii., p. 92.

1839. Pleurotoma crenularis, Lamarck. Anim. S. Vert. (Deshayes and Edwards, 3rd ed.), vol. iii., p. 624, No. 7.

1843. Pleurotoma crenularis, Reeve. Conch. Icon., vol. i., pl. 7, f. 54.

1884. Drillia crenularis, Tryon. Man. Conch., vol. vi., p. 178, pl. 10, f. 64, and pl. 32, f. 38.

1887. Drillia crenularis, Weinkauff. Conch. Cab. (ed. Küster), p. 47, No. 48, pl. 10, f. 6.

Hab.—Portland (Mrs. A. F. Kenyon), one specimen only obtained.

Obs.—This is a very fine species, the specimen found measuring 37 mm. in length.

DRILLIA TELESCOPIALIS, Verco.

1896. Drillia telescopialis, Verco. T.R.S. S.A., p. 222, pl. 7, f. 1, 1*a*, 1*b*.

Hab.—Portsea (T. S. Hall).

DRILLIA HOWITTI, Pritchard and Gatliff.

1899.—Drillia howitti, Pritchard and Gatliff. P.R.S. Vic., vol. xii., n.s., pt. i., p. 101, pl. 8, f. 2.

Hab.—Gippsland coast.

Obs.—The type of this species is in Mr. Gatliff's private collection.

DRILLIA GABRIELI, Pritchard and Gatliff.

1899. Drillia gabrieli, Pritchard and Gatliff. P.R.S. Vic., vol. xii., n.s., pt. i., p. 100, pl. 8, f. 1.

Hab.—Dredged alive in about five fathoms off Phillip Island, Western Port (C. J. Gabriel).

Obs.—The type of this species is in Mr. Gatliff's private collection.

Genus **Mangilia**, Risso, em. 1826 (Mangelia).

MANGILIA PICTA, Adams and Angas.

1863. Mangelia picta, Adams and Angas. P.Z.S. Lond., p. 419, pl. 37, f. 7.

1875. Mangelia meredithiæ, T. Woods. P.R.S. Tas., p. 142.

1878. Drillia tæniata, T. Woods. *Id.*, p. 36.

1884. Mangilia picta, Tryon. Man. Conch., vol. vi., p. 256, pl. 22, f. 72.

1896. Mangilia picta, Sowerby. P. Mal. S. Lond., vol. ii., p. 29.

Hab.—Coast generally.

Obs.—The type has a broad brown band on the body whorl, covering the upper half, and occupying almost the whole of the other whorls, this style of marking is seldom met with on our shells, the usual one being an encircling row of colour dashes immediately below the suture, between the ribs. We have specimens 18 mm. in length.

MANGILIA MITRALIS, Adams and Angas.

1863. Bela mitralis, Adams and Angas. P.Z.S. Lond., p. 420, No. 8.

1863. Bela australis, Adams and Angas. *Id.*, No. 9.

1878. Mangelia alternata, T. Woods. P.R.S. Tas., p. 39.

1896. Mangilia australis, Sowerby. P. Mal. S. Lond., vol. ii., p. 31.

Hab.—Coast generally.

Obs.—The type of M. alternata is in the National Museum, Melbourne. We agree with Sowerby in uniting the two species of Adams and Angas, as we have a full series connecting them, but we give precedence to the name first mentioned by the describers. We are not altogether satisfied as to the above generic location, for it seems to us neither a typical Bela, nor a Mangilia, but in some respects recalls Daphnella, but even this is not wholly satisfactory; therefore, pending further consideration we refer to it as above.

MANGILIA VINCENTINA, Crosse and Fischer.

1865. Mangelia? vincentina, Crosse and Fischer. Jour. d. Conch., p. 422, pl. 11, f. 6.

1884. Daphnella vincentina, Tryon. Man. Conch., vol. vi., p. 311, pl. 17, f. 91.

1896. Mangilia vincentina, Sowerby. P. Mal. S. Lond., vol. ii., p. 30.

Hab.—Port Phillip; Western Port; Portland.

MANGILIA ANOMALA, Angas.

1877. Purpura (Cronia) anomala, Angas. P.Z.S. Lond., p. 34, pl. 5, f. 1.

1880. Murex (Ocinebra) anomala, Tryon. Man. Conch., vol. ii., pp. 121 and 180, pl. 36, f. 422.

1884. Cronia anomala, Tryon. *Id.*, vol. vi., p. 318.

1890. Mangilia anomala, Tate. P.L.S., N.S.W., vol. v., p. 131.

1896. Mangilia anomala, Sowerby. P. Mal. S. Lond., vol. ii., p. 31.

Hab.—Port Phillip; Western Port; Portland; and coast generally.

Obs.—As above indicated Tryon does not regard this shell as a Mangilia, and states on p. 318 that he cannot agree with those who regard it as such.

MANGILIA ADCOCKI, Sowerby.

1863. Mangelia bella, Adams and Angas (non Hinds). P.Z.S. Lond., p. 419, pl. 37, f. 6.

1877. Cithara gracillima, T. Woods, m.s.

1884. Mangilia boakei, Tryon (non Nevill). Man. Conch., vol. vi., p. 270, pl. 25, f. 36.

1896. Mangilia adcocki, Sowerby. P. Mal. S. Lond., vol. ii., p. 29, pl. 3, f. 18.

Hab.—Western Port; Port Phillip; and Puebla coast.

Obs.—A shell named C. gracillima, T. Woods, has been set out in the National Museum, Melbourne, since 1877, but we have been unable to find any published description of it. We have a variety of this shell slightly longer and narrower than the type, of a uniform white excepting at the apex which is brown; and we have another form which is more robust, the whorls more convex, and the costæ are more strongly developed.

MANGILIA TASMANICA, T. Woods.

1875. Cithara tasmanica, T. Woods. P.R.S. Tas., p. 145.

1877. Mangelia jacksoniensis, Angas. P.Z.S. Lond., p. 37, pl. 5, f. 10.

1884. Daphnella jacksonensis, Tryon. Man. Conch., vol. vi., p. 311, pl. 22, f. 73.

Hab.—Port Fairy (Rev. T. Whan).

Obs.—This species is nearly related to M. mitralis, Adams and Angas, but is much narrower in form and more turreted.

MANGILIA ALUCINANS, Sowerby.

1896. Mangilia alucinans, Sowerby. P. Mal. S. Lond., vol. ii., p. 29, pl. 3, f. 12.

Hab.—Port Phillip; Western Port; Portland; and coast generally.

Obs.—This shell has usually hitherto been known as M. lineata, Reeve, but we have carefully referred to his original description and figure, and it is not that species.

MANGILIA FLACCIDA, Pritchard and Gatliff.

1899. Mangilia flaccida, Pritchard and Gatliff. P.R.S. Vic., vol. xii., n.s., pt. 1, p. 102, pl. 8, f. 3, 4.

Hab.—San Remo, Western Port.

Obs.—The type of this species is in Mr. Gatliff's private collection. This species is in all probability the one that has on several occasions been confused with Mangilia pura, Reeve.

Genus **Cithara**, Schumacher, 1817 (Cythara).

CITHARA COMPTA, Adams and Angas.

1863. Cithara compta, Adams and Angas. P.Z.S. Lond., p. 419, pl. 37, f. 5.
1876. Daphnella varix, T. Woods. P.R.S. Tas., p. 10.
1884. Daphnella compta, Tryon. Man. Conch., vol. vi., p. 306, pl. 25, f. 49.
1896. Cythara compta, Sowerby. P. Mal. S. Lond., vol. ii., p. 31.

Hab.—Flinders; San Remo; Sorrento.

CITHARA COGNATA, Pritchard and Gatliff.

1899. Cithara cognata, Pritchard and Gatliff. P.R.S. Vic., vol. xii., n.s., pt. i., p. 103, pl. 8, f. 5.

Hab.—Dredged alive in about five fathoms off Phillip Island, Western Port (C. J. Gabriel).

Obs.—The type of this species is in Mr. Gatliff's private collection.

Genus **Clathurella**, Carpenter, 1857.

CLATHURELLA TINCTA, Reeve.

1846. Pleurotoma tincta, Reeve. Conch. Icon., vol. i., pl. 38, f. 347.
1846. Pleurotoma albifuniculata, Reeve. *Id.*, f. 350.
1876. Clathurella rubroguttata, H. Adams. P.Z.S. Lond., p. 14, pl. 3, f. 25.
1877. Mangelia trachys, T. Woods. T.R.S., Vic., vol. xiv., p. 57.
1884. Clathurella tincta, Tryon. Man. Conch., vol. vi., p. 292, pl. 16, f. 75, 76, and pl. 17, f. 96.
1896. Clathurella tincta, Sowerby. P. Mal. S. Lond., vol. ii. p. 28.

Hab.—Port Phillip; Western Port; Polwarth coast.

Obs.—The type of M. trachys, T. Woods, is in the National Museum, Melbourne, and is recorded from Brighton.

CLATHURELLA MODESTA, Angas.

1877. Clathurella modesta, Angas. P.Z.S. Lond., p. 38, pl. 5, f. 15.

1884. Clathurella modesta, Tryon. Man. Conch., vol. vi., p. 285, pl. 17, f. 92.

1896. Clathurella modesta, Sowerby. P. Mal. S. Lond., vol. ii., p. 28.

Hab.—Port Phillip; Western Port.

CLATHURELLA LALLEMANTIANA, Crosse and Fischer.

1865. Clathurella lallemantiana, Crosse and Fischer. Jour. d. Conch., p. 423, pl. 2, f. 5.

1875. Mangelia immaculata, T. Woods. P.R.S. Tas., p. 142.

1876. Drillia incrusta, T. Woods. *Id.*, p. 136.

1884. Clathurella letourneuxiana, var. lallemantiana, Tryon. Man. Conch., vol. vi., p. 286, pl. 17, f. 86.

1896. Clathurella lallemantiana, Sowerby. P. Mal. S. Lond., vol. ii., p. 28.

Hab.—Port Phillip; Western Port.

CLATHURELLA LETOURNEUXIANA, Crosse and Fischer.

1865. Clathurella letourneuxiana, Crosse and Fischer. Jour. d. Conch., p. 425, pl. 11, f. 7.

1877. Mangelia letourneuxiana, T. Woods. P.R.S. Tas., p. 28.

1884. Clathurella letourneuxiana, Tryon. Man. Conch., vol. vi., p. 286, pl. 17, f. 87.

Hab.—Port Phillip; Western Port.

Obs.—Hutton in his Catalogue of Marine Mollusca, 1873, cites Daphnella letourneuxiana, Crosse, but in his subsequent Manual of New Zealand Mollusca, 1880, it appears from the appendix, page 218, that he has mistaken the species and its correct name is cited by him as Defranchia luteo-fasciata, Reeve.

CLATHURELLA PHILOMENA, T. Woods.

1875. Clathurella philomena, T. Woods. P.R.S. Tas., p. 141.

1876. Siphonalia pulchra, T. Woods. *Id.*, p. 139.

1880. Clathurella crassina, Angas. P.Z.S. Lond., p. 416, pl. 40, f. 6.

1896. Clathurella parvula, Sowerby (non Reeve). P. Mal. S. Lond., vol. ii., p. 28.

Hab.—Port Phillip, Western Port; Portland (C. M. Maplestone); dredged off Phillip Island, Western Port, about 5 fathoms (C. J. Gabriel).

Obs.—The above species is fairly abundant in Port Phillip and Western Port. After carefully considering the meagre description and figure of Pleurotoma parvula, Reeve, Conch. Icon., vol. i., pl. 28, f. 254, and being unable to see the actual type we cannot agree with the conclusions of Sowerby in Proc. Mal. S. Lond., vol. ii., p. 28; our shell is more nearly related to Clavatula spurca, Hinds, and still closer to C. rava, Hinds.

The specimens dredged, above alluded to, are of greater length than usual, and the upper portion of the body whorl is not so angulate.

T. Woods himself acknowledges Siphonalia pulchra as an immature state of Clathurella philomena, in the Proceedings of the Royal Society of Tasmania for 1879, amongst some other corrections in a note to his paper on some Tasmanian Trochidæ.

Clathurella kymatoëssa, Watson.

1886. Drillia kymatoëssa, Watson. Chall. Zool., vol. xv., p. 309, No. 39, pl. 26, f. 5.

Hab.—Off East Moncoeur Island, Bass Strait (Challenger).

Obs.—In general habit and sculpture this shell is very nearly related to C. philomena, T. Woods, and this is especially noticeable when it is compared with the large specimens of that species dredged in Western Port, probably a connecting series may be established.

Clathurella legrandi, Beddome.

1883. Drillia legrandi, Beddome. P.R.S. Tas., vol. 35, p. 167.

Hab.—Portland (C. M. Maplestone).

Clathurella zonulata, Angas.

1867. Clathurella zonulata, Angas. P.Z.S. Lond., p. 113, pl. 13, f. 17.

1884. Clathurella zonulata, Tryon. Man. Conch., vol. vi. p. 285, pl. 17, f. 89.

Hab.—Western Port.

CLATHURELLA BICOLOR, Angas.

1871. Clathurella bicolor, Angas. P.Z.S. Lond., p. 18, pl. 1, f. 20.

1875. Drillia atkinsoni, T. Woods. P.R.S. Tas., p. 142.

1884. Clathurella bicolor, Tryon. Man. Conch., vol. vi., p. 284, pl. 16, f. 61.

Hab.—Western Port.

CLATHURELLA SEXDENTATA, Pritchard and Gatliff.

1899. Clathurella sexdentata, Pritchard and Gatliff. P.R.S. Vic., vol. xii, n.s., pt. 1. p. 104, pl. 8, f. 7.

Hab.—Sorrento Beach, Port Phillip.

Obs.—The type of this species is in Mr. Gatliff's private collection, and is a related form to C. modesta, Angas.

Genus Raphitoma, Bellardi, 1847.

RAPHITOMA HARRISONI, T. Woods.

1863. Euryta pulchella, Adams and Angas (non Terebra pulchella, Deshayes). P.Z.S. Lond., p. 418, pl. 37. f. 14.

1865. Euryta pulchella, Angas. *Id.*, p. 169.

1875. Euryta brazieri, Angas (non Terebra brazieri, Angas). *Id.*, p. 390, pl. 45, f. 5, 5*a*.

1877. Mangelia harrisoni, T. Woods. P.R.S. Vic., p. 56.

1884. Daphnella harrisoni, Tryon. Man. Conch., vol. vi., p. 306.

1885. Terebra (Euryta) angasi, Tryon. *Id.*, vol. vii., p. 38, pl. 12, f. 26.

1886. Terebra (Euryta) angasi, Tate. Southern Science Record, p. 4.

1887. Pleurotoma (Cithara) harrisoni, Gatliff. V.N., vol. iv., p. 59.

1894. Terebra (Euryta) harrisoni, Brazier. P.L.S., N.S.W., vol. ix., p. 693.

Hab.—Western Port.

Obs.—This shell undoubtedly belongs to the family Pleurotomidæ, and of the preceding genera, we think, after careful comparison with species of Raphitoma, that it is best classed as such.

Genus **Mitromorpha**, A. Adams, 1865.

MITROMORPHA FLINDERSI, Pritchard and Gatliff.

1899. Mitromorpha flindersi, Pritchard and Gatliff. P.R.S. Vic., vol. xii., n.s., pt. 1, p. 104, pl. 8, f. 6.

Hab.—Ocean Beach, Flinders; and Western Port.

Obs.—The type of this species is in Mr. Gatliff's private collection.

Family CONIDÆ.

Genus **Conus**, Linnæus, 1758.

CONUS ANEMONE, Lamarck.

1810. Conus anemone, Lamarck. Ann. du Mus., vol. xv., p. 272.

1822. Conus anemone, Lamarck. Anim. S. Vert, vol. vii., p. 479.

1841. Conus maculosus, Sowerby. Conch. Illus., f. 3.

1843. Conus anemone, Lamarck. Anim. S. Vert. (Deshayes ed.), vol. xi., p. 61, No. 78.

1843. Conus anemone, Reeve. Conch. Icon., vol. i., pl. 25, f. 139 *a*, *b*.

Conus ardisiacus, Kiener. Icon. Coq. Viv., p. 316, pl. 108, f. 1.

1853. Conus novæ-hollandiæ, A. Adams. P.Z.S. Lond., p. 119.

1859. Conus maculatus, Sowerby. Thes. Conch., vol. iii., p. 31, pl. 199, f. 296.

1859. Conus novæ-hollandiæ, Sowerby. *Id.*, p. 31, pl. 199, f. 298, 299.

1859. Conus anemone, Sowerby. *Id.*, p. 31, pl. 201, f. 339-341.

1875. Conus anemone, Weinkauff. Conch. Cab. (ed. Küster), p. 244, No. 198, pl. 41, f. 1-5.

1884. Conus anemone, Tryon. Man. Conch., vol. vi., p. 69, pl. 22, f. 55-57.

1886. Conus anemone, Watson. Chall. Zool., vol. xv., p. 385.

1898. Conus remo, Brazier. P.L.S., N.S.W., vol. xxiii., pt. 2, p. 271.

1898. Conus flindersi, Brazier. *Id.*, p. 780.

Hab.—Coast generally, in rocky pools.

Obs.—Weinkauff in the Conchylien Cabinet (ed. Küster) p. 245, considers C. jukesii, Reeve, as equal to C. anemone, Lamarck, with this, Watson in his Challenger report does not agree (see p. 386), and gives what appear to be excellent reasons for retaining the two species as distinct. Tryon also in his Manual of Conchology regards C. jukesii, as a variety of C. anemone. We certainly agree with Watson.

This shell differs greatly in shape, the spire is sometimes very slightly elevated, exceptionally it is very produced, comprising one-third of the entire length, and more rarely it is scalariform. After his original description Lamarck describes two varieties of colouration; there are many more, the most remarkable being a pure white variety, of which we have obtained many specimens on what is known as the Ocean Beach, Sorrento; on some other specimens the markings are of a rich orange colour, but the transverse elevated striæ mentioned by Lamarck, is a feature always present, although varying in degree. The type is mentioned as being 42 mm. in length, we have one before us measuring 64 mm.

We have carefully examined the types of the two last shells quoted, described by Mr. Brazier, and are much surprised that such an authority should have forgotten his cunning to such an extent as to fail to recognise this common and variable species. The further encumbering of species by needless synonymy is difficult to restrain under present procedure, especially if those locally interested have no opportunity of criticism until after the mischief has been accomplished.

Conus rutilus, Menke.

1843. Conus rutilus, Menke. Moll. Nov. Holl., p. 27, No. 133.

1844. Conus rutilus, Reeve. Conch. Icon., vol. i., pl. 47, f. 264.

1857. Conus rutilus, Sowerby. Thes. Conch., vol. iii., p. 5, pl. 200, f. 323.
1875. Conus tasmanicus, T. Woods. P.R.S. Tas., p. 139.
1876. Conus macleayana, T. Woods. *Id.*, p. 134.
1877. Conus smithi, Angas. P.Z.S. Lond., p. 36, pl. 5, f. 8.
1879. Conus rutilus, T. Woods. P.R.S. Tas., p. 69.
1884. Conus rutilus, Tryon. Man. Conch., vol. vi, p. 24, pl. 6, f. 3.
1884. Conus smithi, Tryon. *Id.*, pl. 6, f. 4.
1887. Conus smithi, Sowerby. Thes. Conch., vol. v., p. 259, pl. 510, f. 692.

Hab.—Coast generally, commonest in Western Port.

Obs.—This pretty little species has a very wide distribution round Australia and on the north coast of Tasmania. Specimens from our shores attain to a length of 18 mm. by a breadth of 11 mm., and show a considerable variation in colour, from violet through shades of brown to salmon or pinkish; also in the spire we find flat or tabulate forms, occasionally it is much elevated and coronate.

CONUS SEGRAVEI, Gatliff.

1890. Conus segravei, Gatliff. V.N., vol. vii., p. 179 (with a plate of two figures).

Hab.—Beach near Shoreham, Western Port (Gatliff).

Obs.—Figure 11*a*, plate 3, in Reeve's Conchologia Iconica of C. ammiralis, Lin., much resembles our shell, but the former is a small and granulated variety with a slightly coronated spire. Our species may be readily distinguished from it, and also from C. anemone, Lam., by the smoothness of the body whorl. Since the shell was described some more specimens have been obtained by one of us at the locality named. The type of this species is in Mr. Gatliff's private collection.

Family STROMBIDÆ.

Genus Strombus, Linnæus, 1758.

STROMBUS FLORIDUS, Lamarck.

1822. Strombus floridus, Lamarck. Anim. S. Vert., vol. vii., p. 211, No. 27.

1833. Strombus mutabilis, Swainson. Zool. Illus., 1st ser., vol. ii., pl. 71, f. 1.

1834. Strombus floridus, Quoy and Gaimard. Astrolabe Zool., vol. iii., p. 76, pl. 51, f. 12, 13.

Strombus floridus, Kiener. Icon. Coq. Viv., p. 63, pl. 32, f. 1, 1*a*, 1*c*.

1839. Strombus floridus, Lamarck. Anim. S. Vert. (3rd ed. Deshayes and Edwards), vol. iii., p. 750.

1842. Strombus mutabilis, Sowerby. Thes. Conch., vol. i., p. 29, pl. 7, f. 40, 45, 46, 47, 49, 52.

1843. Strombus floridus, Lamarck. Anim. S. Vert., (Deshayes ed.), vol. ix., p. 707.

1845. Strombus floridus, Küster. Conch. Cab., vol. iv., Genus, p. 53, No. 35, pl. 9, f. 8-10.

1849. Strombus floridus, Reeve. Conch. Icon., vol. vi., pl. 7, f. 11*a*, *b*.

1885. Strombus (Canarium) floridus, Tryon. Man. Conch., vol. vii., p. 119, pl. 7, f. 73, 74.

Hab.—Portland (C. M. Maplestone); Port Fairy (Rev. T. Whan).

Obs.—We have never collected this species ourselves. Tryon gives several other synonyms, but with these we have been unable to agree.

Family CYPRÆIDÆ.

Genus **Cypræa**, Linnæus, 1758.

CYPRÆA ANGUSTATA, Gmelin.

CYPRÆA ANGUSTATA, var. *piperita*, Gray.

CYPRÆA ANGUSTATA, var. *comptoni*, Gray.

CYPRÆA ANGUSTATA, var. *bicolor*, Gaskoin.

CYPRÆA ANGUSTATA, var. *declivis*, Sowerby.

CYPRÆA ANGUSTATA, var. *albata*, Beddome.

We cite the following references:—

1790. Cypræa angustata, Gmelin. Syst. Nat., p. 3421.

1846. Cypræa angustata, Reeve. Conch. Icon., vol. iii., pl. 17, f. 91.

1824. Cypræa piperita, Gray. Zool. Jour., vol. i., p. 498.

1847. **Cypræa comptoni, Gray. Jukes, Voyage H.M.S. "Fly," vol. ii., appendix p. 356, pl. 1, f. 3.**

1848. **Cypræa bicolor, Gaskoin. P.Z.S. Lond., p. 92.**

1870. **Cypræa piperita, Sowerby. Thes. Conch., vol. iv., p. 31, pl. 319, f. 285, 286.**

1870. **Cypræa piperita, var. bicolor, Sowerby. Thes. Conch., vol. iv., pl. 319, f. 289, and pl. 328, f. 533.**

1870. **Cypræa declivis, Sowerby. *Id.*, p. 31, pl. 319, f. 287, and pl. 321, f. 328*, 329.**

1898. **Cypræa albata, Beddome. P.L.S., N.S.W., p. 571, pl. 21, f. 11.**

Hab.—Coast generally, in rocky parts.

Obs.—After a careful study of some hundreds of specimens before us, we arrive at the conclusion that there is only one species, showing very great variation, both in form and colouration.

C. angustata, the type, is the dominant form throughout, and usually attains to the greatest size of any of the series, and we would define the principal distinguishing character of this form in contradistinction to its varieties, as being of a uniform colour on the dorsum, in fresh specimens generally purplish or reddish-brown, and showing no bands. We would class the varieties in the order of the date of naming, as follows :—

Var. piperita. Type described as having four bands on the dorsum, being dotted or speckled, and other colouration of dorsum very light brown.

Var. comptoni. Type described as having three bands on the dorsum. No spots on the dorsum are mentioned. Other colouration as in C. angustata, but much paler in tint, occasionally being cream colour.

Var. bicolor. Type described as of a light cream colour, and having three broad irregularly interrupted bands crossing the dorsum. No spots on the dorsum mentioned.

Var. declivis. Type described as having the dorsum of a rosy yellow hue sprinkled over with small spots. No bands are mentioned.

Var. albata. Type described as having a snow white shell, not showing any spots.

Remarks on the Varieties.

Var. piperita. This form shows great diversity, sometimes the shape is pyriform, but it is sometimes relatively narrow and elongate, the bands vary in number from 3 to 4, they may be continuous across the back, or discontinuous in the form of broad lines or squarish blotches, or the blotches may assume a crescent shape, occasionally V shaped, recalling C. undata, Lamarck. In two specimens before us the dorsal marking consists of broad undulating longitudinal lines of irregular width.

Var. comptoni. This has occasionally only one broad band across the dorsum, the usual number is 3 to 4, but sometimes only 2, and they are continuous across the shell.

Var. bicolor. Examples we include with this form are occasionally longer and narrower than the type, with darker colouration; in rare specimens, which we would also class here, the darker wave lines run lengthwise instead of across the dorsum. This variety and variety piperita are difficult to separate from one another.

Var. declivis. The dorsal spots are sometimes on a purely white or a faint brown ground, and sometimes confluent, and in some specimens the dorsal blotchings at the extremities are entirely absent.

Var. albata. This is the rarest and also the most distinct variety, owing to the entire absence of the dark spots on the margins; besides the typical white shell, we have others before us narrower in form, and of a pinkish flesh colour, that have no spots or bands.

In worn specimens of var. piperita, the small dorsal spots are often absent, and the shell then resembles either var. comptoni or var. bicolor.

An examination of young shells ranging from 7 mm. to 22 mm. in length, in which the outer lip is acute, shows that as might be expected, var. albata, has no markings, all the others, with the exception probably of var. declivis, appear to start with five dotted lines, one of them immediately encircling the spire; this one soon becomes hidden, and the lower one generally as the shell grows is discontinued; two of the other bands often unite forming a broad central band, the change being distinctly

discernable on the columellar side of many shells that have not fully attained adult growth. In C. angustata the lines are all discontinued, and the shell generally becomes of a uniform brown, varying, however, in tint. The spots on the dorsum are, we think, the last formed, as we have seen no trace of them in the very young shells, and we infer that probably the young of the varieties declivis and albata, prior to the in-turning of the outer lip are identical.

We consider from the descriptions and figures of C. angustata varieties mayi, and subcarnea, Beddome, that the former is var. comptoni, and the latter a somewhat rare form of the type C. angustata.

We think it probable that a large representative collection of West Australian specimens of this species will lead to the inclusion of C. pulicaria, Reeve, as being another variety of C. angustata.

All the adult shells, with the exception of var. albata, have the round dark spots on the margin, and encircling the shell at the base, these spots vary greatly in size on different specimens, and are occasionally absent at the ends, at other times they are very numerous at the ends and become confluent.

To assist in following our definitions we give the following synopsis :—

Synopsis.

Dorsum brown, no bands, no spots,—C. angustata.

Dorsum light brown or cream, no bands, but numerous spots,—var. declivis.

Dorsum light brown or cream, with bands and numerous spots, —var. piperita.

Dorsum light brown or cream, with continuous bands, but no spots,—var. comptoni.

Dorsum cream or light brown, with interrupted bands, but no spots,—var. bicolor.

Without bands or spots of any kind,– var. albata.

Note.—In the references we have only cited the original, in each case, and a second reference which gives a figure, when one was not given with the original description. C. angustata was re-named C. maculata by Perry in 1811, but we do not know of any instance where this synonym has been used in Australia.

CYPRÆA UMBILICATA, Sowerby.

1825. Cypræa umbilicata, Sowerby. Tankerville Cat. App., p. 30, pl. 7, No. 2260.

1829. Cypræa umbilicata, Gray. Zool., Journal., vol. iv., p. 77.

1845. Cypræa pantherina, (*monstrosity*), Reeve. Conch. Icon., vol. iii., species 7.

1870. Cypræa umbilicata, Sowerby. Thes. Conch., vol. iv., pl. 298, f. 42-44.

1885. Cypræa umbilicata, Tryon. Man. Conch., vol. vii., p. 181, pl. 12, f. 65, 66.

1898. Cypræa umbilicata, Beddome. P.L.S., N.S.W., pp. 564-568.

Hab.—Gippsland Coast; Portland.

NOTE.—Cypræa annulus, Lin., has been said to have been collected from our coast more than ten years ago, but we have been unable to find any trace of it hitherto.

Sub-genus **Trivia**, Gray, 1832.

TRIVIA AUSTRALIS, Lamarck.

1822. Cypræa australis, Lamarck. Anim. S. Vert., vol. vii., p. 404.

1834. Cypræa australis, Quoy and Gaimard. Astrolabe Zool., vol. iii., p. 48, pl. 48, f. 19-26.

Cypræa australis, Kiener. Icon. Coq. Viv., p. 138, sp. 125, pl. 48, f. 2.

1838. Cypræa rosea, Duclos. Potiez. Gall. des Moll., p. 477.

1844. Cypræa australis, Lamarck. Anim. S. Vert. (ed. Desh.), vol. x., p. 545.

1846. Cypræa australis, Reeve. Conch. Icon., vol. iii., pl. 24, f. 138.

1870. Cypræa (Trivia) australis, Sowerby. Thes. Conch., vol. iv., p. 45, pl. 325, f. 439, 440.

1881. Cypræa australis, Weinkauff. Conch. Cab. (ed. Küster), p. 142, pl. 49, f. 14, 15.

1885. Trivia australis, Tryon. Man. Conch., vol. vii., p. 206, pl. 23, f. 53, 54.

1898. Trivia australis, Beddome. P.L.S., N.S.W., p. 576, pl. 21, f. 19.

Hab.—Coast generally, rather common.

TRIVIA ORYZA, Lamarck.

1810. Cypræa oryza, Lamarck. Ann. du Mus., vol. xvi., p. 104.

1822. Cypræa oryza, Lamarck. Anim. S. Vert., vol. vii., p. 403.

1844. Cypræa oryza, Lamarck. Anim. S. Vert. (ed. Desh.), vol. x., p. 543.

1846. Cypræa oryza, Reeve. Conch. Icon., vol. iii., pl. 24, f. 140.

1870. Cypræa (Trivia) oryza, Sowerby. Thes. Conch., vol. iv., p. 46, pl. 326, f. 474, 475.

1885. Trivia oryza, Tryon. Man. Conch., vol. vii., p. 200, pl. 21, f. 82, 83.

Hab.—Port Phillip, dredged in 5 fathoms (McGillivray, Voyage of "Rattlesnake" appendix p. 363).

Genus **Erato**, Risso, 1826.

ERATO DENTICULATA, Pritchard and Gatliff, m.s.

Hab.—San Remo; Otway Coast, between Ryan's Den and Moonlight Head (Mr. P. J. Fulton).

Obs.—This species is somewhat related in form to E. sandwiciensis, Pease, described in the Proceedings of the Zoological Society of London for 1860, p. 146. This and another new species, whose descriptions are now ready for publication, are recorded under manuscript names as they were not sufficient to make up a plate by themselves, but as soon as sufficient of the remaining new material has been considered, we will publish their figures and descriptions.

Family CASSIDIDÆ.

Genus **Cassis**, Klein, 1753.

CASSIS FIMBRIATA, Quoy and Gaimard.

1833. Cassis fimbriata, Quoy and Gaimard. Astrolabe, Zool., vol. ii., p. 596, pl. 43, f. 7, 8.

Cassis fimbriata, Kiener. Icon. Coq. Viv., pl. 4, f. 6.

1848. Cassis fimbriata, Reeve. Conch. Icon., vol. v., pl. 7, f. 17.

1857. Cassis fimbriata, Küster. Conch. Cab., p. 28, pl. 47, f. 12, and pl. 48, f. 12.

1885. Cassis fimbriata, Tryon. Man. Conch., vol. vii., p. 272, pl. 3, f. 35.

Hab.—Portland.

CASSIS PYRUM, Lamarck.

1844. Cassis pyrum, Lamarck. Anim. S. Vert. (Deshayes ed.), vol. x., p. 33.

1848. Cassis pyrum, Reeve. Conch. Icon., vol. v., pl. 11, f. 29.

1857. Cassis pyrum, Küster. Conch. Cab., p. 29, pl. 47, f. 56.

1872. Cassis nivea, Brazier. P.Z.S. Lond., p. 616, pl. 44, f. 1.

1880. Cassis pyrum, Hutton. Man. N.Z. Moll., p. 66.

1885. Cassis (Casmaria) achatina var. pyrum, Tryon. Man. Conch., vol. vii., p. 278, pl. 8, f. 96-98.

1885. Cassis tumida, Petterd. P.R.S. Tas., p. 321.

Hab.—Port Phillip; Western Port; Gippsland Coast; Airey's Inlet; Otway Coast.

Obs.—We cannot agree with Tryon in regarding C. paucirugis, Menke, as a synonym; that species is numerously and strongly denticulated within the lip, a feature never present in C. pyrum. C. tumida, Petterd, is a young immature shell. Some of the largest Victorian specimens of this species hitherto obtained have been collected in Port Phillip Bay.

CASSIS ACHATINA, Lamarck.

1844. Cassis achatina, Lamarck. Anim. S. Vert. (Deshayes ed.), vol. x., p. 33.

1848. Cassis achatina, Reeve. Conch. Icon., vol. v., pl. 11, f. 28*a*.

1857. Cassis achatina, Küster. Conch. Cab., p. 34, pl. 50, f. 3, 4.

1867. Cassis achatina, Angas. P.Z.S. Lond., p. 196.

1880. Cassis achatina, Hutton. Man. N.Z. Moll., p. 66, and p. 202.

1885. Cassis (Casmaria) achatina, Tryon. Man. Conch., vol. vii., p. 278, pl. 8, f. 94.

Hab.—San Remo; Bass' Straits (Tenison Woods); Waratah Bay (Miss Stirling).

CASSIS SEMIGRANOSA, Lamarck.

1822. Cassis semigranosa, Lamarck. Anim. S. Vert., vol. vii., p. 228, No. 23.

1828. Cassis semigranosa, Wood. Index Test. Supp., pl. 4, f. 2.

1844. Cassis semigranosa, Lamarck. Anim. S. Vert. (Deshayes ed.), vol. x., p. 37.

1848. Cassis semigranosa, Reeve. Conch. Icon., vol. v., pl. 1, f. 3.

1857. Cassis semigranosa, Küster. Conch. Cab., p. 24, pl. 44, f. 6, 7.

1885. Carris (Semicassis) semigranosa, Tryon. Man. Conch., vol. vii., p. 275, pl. 3, f. 60.

Hab.—Port Phillip; Western Port; Gippsland coast; Otway coast.

Family NATICIDÆ.

Genus Natica, Adanson, 1757.

NATICA PLUMBEA, Lamarck.

1822. Natica plumbea, Lamarck. Anim. S. Vert. (Deshayes ed.), vol. viii., p. 632.

1832. Natica plumbea, Quoy and Gaimard. Astrolabe, Zool., vol. ii., p. 234, pl. 66, f. 13-15.

1833. Natica sordida, Swainson. Zool. Illus., vol. ii., pl. 79.

1833. Natica melastoma, Swainson. *Id.*, pl. 79.

1839. Natica plumbea, Lamarck. Anim. S. Vert. (3rd edition, Deshayes and Edwards), vol. iii., p. 493.

1841. Natica sanguinolenta, Deshayes. Guerin's Magazine de Zool., pl. 46.

1855. Natica plumbea, Reeve. Conch. Icon., vol. ix., pl. 9, f. 34*a*, *b*.

1855. Natica leucoptræa, Reeve. *Id.*, pl. 12, f. 51.

1855. Natica melastoma, Reeve. *Id.*, pl. 18, f. 78.

1855. Natica strangei, Reeve. *Id.*, pl. 18, f. 81.

1883. Natica leucoptræa, Sowerby. Conch. Icon., vol. v., p. 88, pl. 458, f. 60.

1883. Natica plumbea, Sowerby. *Id.*, p. 87, pl. 459, f. 69.

1883. Natica strangei, Sowerby. *Id.*, p. 87, pl. 459, f. 80.

1883. Natica melastoma, Sowerby. *Id.*, p. 87, pl. 460, f. 100.

1886. Natica plumbea, Tryon. Man. Conch., vol. viii., p. 44, pl. 18, f. 78.

1886. Natica leucoptræa, Tryon. *Id.*, p. 45, pl. 18, f. 80, 82.

1886. Natica melastoma, Tryon. *Id.*, p. 45, pl. 18, f. 81.

Hab.—Coast generally.

Obs.—This species varies greatly in shape, from a somewhat conical to almost globose form; its chief distinguishing characters are, the blood red callosity of the columella, dark interior, and greyish coloured exterior. The callosity only partially covers the umbilicus in the type, but entirely covers it in some examples from Western Australia = N. melastoma, Swainson, and some examples from New South Wales show a medium development in this respect.

Natica didyma, Chemnitz.

Natica didyma, Bolten, m.s.

Natica didyma, Chemnitz. Conch. Cab. vol. v. p. 246, pl. 186, f. 1856-59.

1848. Natica bicolor, Philippi. Zeitschrift. f. malak. p. 156.

1848. Natica ampla, Philippi. *Id.*, p. 156.

1851. Natica papyracea, Philippi. Abh. und. Besch., vol. ii, p. 45, sp. 12, pl. 2, f. 12.

1852. Natica didyma, Philippi. Conch. Cab. (ed. Küster) vol. iii, p. 6, sp. 1, pl. 1, f. 1-4.

1852. Natica papyracea, Philippi. Conch. Cab. (ed. Küster) vol. ii, p. 43, sp. 42*b*, pl. 5, f. 4, and p. 87, sp. 99, pl. 13, f. 4.

1852. Natica bicolor, Philippi. *Id.*, p. 43, sp. 42, pl. 6, f. 4.

1852. Natica ampla, Philippi. *Id.*, p. 41, sp. 40, pl. 6, f. 2.

1855. Natica chemnitzii, Reeve. (From Recluz, m.s.), (non N. chemnitzii, Pfeiffer). Conch. Icon., vol. ix., pl. 2, f. 7.

1855. Natica lamarckiana, Reeve. (From Recluz, m.s.). *Id.*, pl. 2, f. 6.

1855. Natica petiveriana, Reeve. (From Recluz, m.s.). *Id.*, pl. 5, f. 17.

1855. Natica problematica, Reeve. *Id.*, pl. 6, f. 21.

1875. Natica tasmanica, T. Woods. P.R.S. Tas., pp. 148-149.

1883. Natica didyma, Sowerby. Thes. Conch., vol. v., pts. 39, 40, p. 77, sp. 7, pl. 454 (1 gen.), f. 4, and pl. 455, f. 14.

1886. Natica (Neverita) didyma, Watson. Chall. Zool., vol. xv., p. 450, No. 23.

1886. Natica ampla, Tryon. Man. Conch., vol. viii., p. 32, pl. 10, f. 81, 82, 85, 86, and pl. 11, f. 91, 93.

Hab.—Common at most of the sandy parts of our coast.

Obs.—Outside Victoria this species appears to have an extremely wide range, as, in addition to the whole Australian coast, it is recorded as far north as China and Japan, also throughout the Indian Ocean, and as a consequence the form of the species is so variable as to have occasioned considerable confusion. There seems to be no choice but to include the whole of the above under one species when a considerable number of specimens are considered in series. In the above reference to Tryon, figure 81, refers to N. didyma, f. 82 to N. chemnitzii, f. 85 to N. papyracea, f. 86 to N. lamarckiana, and on plate 11, f. 91 to N. petiveriana, and f. 93 to N. problematica; he also includes N. incisa, Dunker, plate 10, f. 83, and N. vesicalis, Philippi, plate 11, f. 92, as synonyms, but with these we cannot agree.

As a digest of some of the more important features we cannot do better than quote the remarks made by Mr. E. A. Smith on this species:—"This species varies considerably in form, and the extent of the umbilical callosity, which, however, displays a quite constant peculiarity in being subdivided by a more or less deeply transverse furrow. The umbilicus, too, is much more open in the typical form than in the var. named by Recluz, Natica chemnitzii. . . . . Colour is of no assistance, the chief variation consisting in the intensity of the tint of the aperture and the whiteness of the base."

NATICA CONICA, Lamarck.

1838. Natica conica, Lamarck, Anim. S. Vert., vol. viii., p. 632.

1839. Natica conica, Lamarck. Anim. S. Vert. (3rd edition, Deshayes and Edwards), vol. iii., p. 493.

1852. Natica conica, Philippi. Conch. Cab. (ed. Küster), p. 102, sp. 115, pl. 15, f. 3.

1855. Natica conica, Reeve. Conch. Icon., vol. ix., pl. 12, f. 48.

1883. Natica conica, Sowerby. Thes. Conch., vol. v., p. 88, pl. 456, f. 25.

1883. Natica ustulata, Sowerby. *Id.*, p. 88, pl. 461, f. 112.

1886. Natica conica, Tryon. Man. Conch., vol. viii., p. 44, pl. 18, f. 76, 77.

Hab.—Coast generally.

Obs.—Readily distinguished from our other species by its more conical form.

NATICA SAGITTATA, Menke.

1843. Natica sagittata, Menke. Moll. Nov. Holl., p. 10, No. 30.

1855. Natica proxima, Reeve (non Adams). Conch. Icon., vol. ix., pl. 27, f. 126*c* only.

1886. Natica canrena, Tryon (non Lin.). Man. Conch., vol. viii., p. 20, pl. 4, f. 59.

Hab.—Port Phillip; Western Port.

Obs.—We have correctly identified specimens of N. marochiensis, Lamarck, before us, with which the above species has been confused, apart from differences of form and colour marking, the umbilical characters are quite distinct.

NATICA INCEI, Philippi.

1851. Natica incei, Philippi. P.Z.S. Lond., p. 233.
1855. Natica incei, Reeve. Conch. Icon., vol. ix., pl. 20, f. 87.
1855. Natica baconi, Reeve. *Id.*, pl. 10, f. 37.
1855. Natica fibula, Reeve. *Id.*, pl. 28, f. 130.
1883. Natica baconi, Sowerby. Thes. Conch., vol. v., p. 76, pl. 454, f. 2.
1883. Natica incei, Sowerby. *Id.*, p. 77, pl. 456, f. 27, pl. 458, f. 63-64, pl. 461, f. 101-103.
1886. Natica (Neverita) incei, Tryon. Man. Conch., vol. viii., p. 33, pl. 10, f. 87-89, and pl. 11, f. 95.

Hab.—Wilson's Promontory (A. H. S. Lucas).

Obs. — Reeve's species, N. baconi, is founded on a large specimen with a predominating bluish-grey tint, and his N. fibula is merely a young shell. Tryon unites with this species, N. clavata, Sowerby, which has especial and striking characters, the specimens before us from Mauritius have the body whorl covered with a light brown epidermis.

NATICA BEDDOMEI, Johnston.

1884. Natica beddomei, Johnston. P.R.S. Tas. p. 208, and 222.
1886. Natica beddomei, Tryon. Man. Conch., vol. viii., p. 54.
1886. Natica effossa, Watson. Chall. Zool., vol. xv., p. 439, and pp. 704-706, pl. 28, f. 3.
1893. Natica beddomei, Tate. T.R.S., S.A., vol. xvii., p. 325.
1895. Natica beddomei, Brazier. P.L.S., N.S.W., vol. ix., 2nd series, p. 692.

Hab.—Dredged, 33 fathoms, sand, off entrance to Port Phillip (Challenger); Portsea; Sorrento; Puebla Coast.

Obs.—Tenison Woods considered this species identical with a fossil species named by him N. polita. but such is not the case.

NATICA SUBCOSTATA, T. Woods.

1878. Natica subcostata, T. Woods. P.L.S. N.S.W., vol ii., p. 263.

Hab.—Dredged off Phillip Island, Western Port, in about 5 fathoms, sandy mud (Chas. J. Gabriel). Two specimens.

Obs.—The type was dredged off Port Jackson Heads, 45 fathoms, it has not yet been figured, but is in the Australian Museum, Sydney. Mr. Chas. Hedley has kindly compared our shell, and writes, "I have carefully compared it with the type of N. subcostata. Except that it is larger, having another half whorl, it corresponds in every feature; without doubt it is identical."

NATICA SHOREHAMI, Pritchard and Gatliff, m.s.

Hab.—Shoreham, San Remo, Western Port; Schnapper Point, Sorrento, Portsea, Port Philllp.

Genus **Sigaretus**, Lamarck, 1799.

SIGARETUS ZONALIS, Quoy and Gaimard.

1832. Cryptostoma zonalis, Quoy and Gaimard. Astrolabe, vol. ii., p. 221, pl. 66 bis., f. 1-3.

1842. Sigaretus australis, Hanley. Young Conchologists' Book of Species p. 57, pl. 1.

1864. Sigaretus zonalis, Reeve. Conch. Icon., vol. xv., pl. 2, f. 6*a*, *b*.

1864. Sigaretus australis, Reeve. *Id.*, pl. 3, f. 15 *a*, *b*.

1882. Sigaretus zonalis, Sowerby. Thes. Conch., vol. v., p. 41, pl. 441, f. 7.

1877. Sigaretus zonalis, T. Woods. P.R.S. Tas., p. 33.

1883. Sigaretus zonalis, Weinkauff. Conch. Cab., p. 27, pl. 6, f. 7-10.

1886. Sigaretus lævigatus, Tryon (non Lamarck). Man. Conch., vol. viii., p. 55, pl. 24, f. 50, 51.

Hab.—Port Phillip; Western Port; Otway Coast.

EUNATICINA UMBILICATA, Quoy and Gaimard.

1832. Natica umbilicata, Quoy and Gaimard. Astrolabe, vol. ii., p. 234, pl. 66, f. 22, 23.

1839. Natica umbilicata, Lamarck. Anim. S. Vert. (3rd ed. Deshayes and Edwards) vol. iii., p. 501.

1855. Natica umbilicata, Reeve. Conch. Icon., vol. ix., pl. 24, f. 108*a*, *b*.

1864. Sigaretus pictus, Reeve. *Id.*, vol. xv., pl. 5, f. 24*a*, *b*.

1875. Ruma globosa, T. Woods. P.R.S. Tas., p. 149.

1882. Sigaretus (Naticina) pictus, Sowerby. Thes. Conch., vol. v. p. 45, pl. 442 bis., f. 36.

1883. Natica umbilicata, Sowerby. *Id.*, p. 98, pl. 457, f. 77.

1883. Sigaretus (Naticina) pictus, Weinkauff. Conch. Cab., p. 45, pl. 10, f. 10, 11.

1886. Natica (Mamilla) umbilicata, Tryon. Man. Conch., vol. viii., p. 52, pl. 22, f. 26.

1886. Sigaretus (Eunaticina) pictus, Tryon. *Id.*, p. 59, pl. 25, f. 92.

1897. Natica umbilicata, Tate. T.R.S., S.A., p. 41.

Hab.—Coast generally.

Obs.—This species is fairly constant in shape, but some specimens are more globose, and others flatter than the type, which is marked with chestnut flamings interrupted by a spiral central white band; sometimes there are rows of encircling dark brown spots = S. pictus, Reeve, and others are entirely white = R. globosa, T. Woods.

EUNATICINA NITIDA, Reeve.

1864. Sigaretus nitidus, Reeve. Conch. Icon., vol. xv., p. 64, f. 20.

1886. Sigaretus (Eunaticina) papilla, var. Tryon. Man. Conch., vol. viii., p. 58, pl. 25, f. 87.

Hab.—Puebla coast.

Obs.—We have been struck with the resemblance of the above to specimens of S. papilla, Gmelin, but our shell is sufficiently distinct to be kept separate unless a uniting series is obtained.

Genus Lamellaria, Montagu, 1815.

LAMELLARIA WILSONI, E. A. Smith.

1886. Lamellaria wilsoni, E. A. Smith. A.M.N.H., V. series, vol. xviii., p. 270, figured.

1887. Lamellaria wilsoni, Wilson. V.N., p. 117.

Hab.—Port Phillip (J. B. Wilson).

LAMELLARIA OPHIONE, Gray.

1849. Lamellaria ophione, Gray. P.Z.S. Lond., p. 169.
1880. Coriocella ophione, Hutton. Man. N.Z. Moll., p. 59.
1886. Lamellaria ophione, Tryon. Man. Conch., vol. viii., p. 63.

Hab.—Western Port; Port Phillip.

Genus **Vanikoro**, Quoy and Gaimard, 1832.

VANIKORO QUOYIANA, A. Adams.

1853. Vanicoro quoyiana, A. Adams. P.Z.S. Lond., p. 175, pl. 20, f. 4.
1867. Vanikoro quoyana, Angas. *Id.*, p. 212.
1886. Vanikoro orbignyana, Tryon (non Recluz). Man. Conch., vol. viii., p. 70.

Hab.—Hobson's Bay (National Museum).

Obs.—Tryon at the reference given misquotes the species as V. quoyi, Adams, and unites it with V. orbignyana; the latter, however, has a narrow and deep umbilicus. Adams does not even mention this character in the description of his species, and Angas states that it is "scarcely umbilicated."

Family HIPPONYCIDÆ.

Genus **Hipponyx**, Defrance, 1819.

HIPPONYX ANTIQUATUS, Linnæus.

1766. Patella antiquata, Linnæus. Syst. Nat., 12th edition, p. 1259, No. 762.
1788. Patella mitrula, Gmelin. Syst. Nat., p. 3708.
1835. Hipponyx foliacea, Quoy and Gaimard. Astrolabe, vol. iii., p. 439, pl. 72, f. 41-45.
1835. Hipponyx mitrula, Sowerby. P.Z.S. Lond., p. 5.
1839. Pileopsis mitrula, Lamarck. Anim. S. Vert. (3rd ed. Deshayes and Edwards), vol. iii., p. 224, No. 2.
1839. Hipponix foliacea, Lamarck. *Id.*; p. 227, No. 4.
1846. Hipponyx mitrula, Sowerby. Thes. Conch., vol. i., p. 369, pl. 73, f. 18-20.

Hab.—Coast generally.

HIPPONYX AUSTRALIS, Lamarck.

1819. Patella australis, Lamarck. Anim. S. Vert., vol. vi., pt. 1, p. 335, sp. 44.

1822. Patella australis, Lamarck. *Id.*, vol. vii., p. 541, sp. 44.

1835. Hipponyx australis, Quoy and Gaimard. Astrolabe, vol. iii., p. 434, pl. 72, f. 25-34.

1835. Hipponyx australis, Quoy and Gaimard. *Id.*, f. 39, 40.

1839. Patella australis, Lamarck. Anim. S. Vert. (3rd ed. Deshayes and Edwards), vol. iii., p. 199, No. 44.

1841. Patella australis, Delessert. Recueil de Coquilles déscrites par Lamarck, f. 11*a*, *b*, *c*.

1858. Amalthea australis, Adams. Genera, vol. i., p. 374, pl. 41, f. 4.

1862. Hipponyx australis, Crosse. Jour. d. Conch., vol. x., p. 21, sp. 6.

1880. Hipponyx australis, Hutton. Man. N.Z. Moll., p. 88.

1886. Hipponyx australis, Tryon. Man. Conch., vol. viii., p. 136, pl. 41, f. 9-15.

1886. Amalthea australis, Watson. Chall. Zool., vol. xv., p. 457, No. 2.

Hab.—Coast generally.

Obs.—This species has been regarded by some as identical with Amalthea conica, Schumacher, Essai Nouv. Gen., p. 181, pl. 21, f. 4, published in 1817; we have been unable to consult this work and are therefore not in a position at present to express an opinion. Watson in his Challenger report, remarks "Capulus danieli, Crosse, approaches this species very closely, but in it the apex turns to the left while in the present shell the apex turns to the right."

Genus **Mitrularia**, Schumacher, 1817.

MITRULARIA EQUESTRIS, Linnæus.

1766. Patella equestris, Linnæus. Syst. Nat., p. 257.

1788. Patella equestris, Gmelin. Syst. Nat., p. 3691, No. 1.

1822. Calyptræa equestris, Lamarck. Anim. S. Vert., vol. vii., p. 264.

1839. Calyptræa equestris, Lamarck. *Id.* (3rd ed. Deshayes and Edwards), vol. iii., p. 230, No. 3.

1858. Calyptræa equestris, Reeve. Conch. Icon., vol. xi., pl. 1, f. 1, *a*, *b*, *c*.

1875. Calyptræa equestris, Woodward. Man. Moll., p. 276, pl. 11, f. 10.

1883. Calyptræa equestris, Sowerby. Thes. Conch., vol. v., p. 55, pl. 445, f. 1, 2.

1886. Mitrularia equestris, Tryon. Man. Conch., vol. viii., p. 137, pl. 41, f. 25, 26.

1887. Mitrularia equestris, Fischer. Man. de. Conch., p. 754, pl. 11, f. 10.

Hab.—Flinders (Segrave).

Obs.—This is a white shell, thin in substance, with a vitreous interior; it is exceedingly variable in form and the synonymy is so great we have refrained from citing it, but the references given will suffice to identify the species; it is very widely distributed in the Southern Hemisphere.

Family Capulidæ.

Genus Calyptræa, Lamarck, 1799.

Calyptræa calytræformis, Lamarck.

1822. Trochus calyptræformis, Lamarck. Anim. S. Vert., vol. vii., p. 12.

1835. Crepidula tomentosa, Quoy and Gaimard. Astrolabe, vol. iii., p. 419, pl. 72, f. 1-5.

1839. Trochus calyptræformis, Lamarck. Anim. S. Vert. (3rd ed. Deshayes and Edwards), vol. iii., p. 546, No. 7.

1843. Trochus calyptræformis, Lamarck. *Id.* (ed. Desh.), vol. ix., p. 125, sp. 7, and p. 162, sp. 9.

1859. Trochita calyptræformis, Reeve. Conch. Icon., vol. xi., pl. 3, f. 11.

1883. Trochita calypræformis, Sowerby. Thes. Conch., vol. v., p. 63, pl. 450, f. 85, 86.

1886. Calyptræa (Sigapatella) calyptræformis, Tryon. Man. Conch., vol. viii., p. 122, pl. 35, f. 96, 97.

1886. Trochita calyptræformis, Watson. Chall. Zool., vol. xv., p. 460, No. 1.

Hab.—Coast generally.

Obs.—Tryon unites with this T. maculata, Quoy and Gaimard, a New Zealand species, which is closely allied, but readily distinguished by its deeper form, and its apex is less central. There is nothing of a pearly nature about either species as described by some authors.

Genus **Crepidula**, Lamarck, 1799.

CREPIDULA UNGUIFORMIS, Lamarck.

1822. Crepidula unguiformis, Lamarck. Anim. S. Vert., vol. vii., p. 642.

1830. Crepidula monoxyla, Lesson. Voyage Coquille, Zool., vol. ii., pt. 1, p. 391.

1835. Crepidula contorta, Quoy and Gaimard. Astrolabe, vol. iii., p. 418, pl. 72, f. 15, 16.

1839. Crepidula unguiformis, Lamarck. Anim. S. Vert. (3rd ed. Deshayes and Edwards), vol. iii., p. 237, No. 4.

1839. Crepidula contorta, Lamarck. *Id.*, p. 237, No. 8.

1859. Crepidula unguiformis, Reeve. Conch. Icon., vol. xi., pl. 1, f. 1.

1873. Crypta contorta, Hutton. Cat. N.Z. Moll., p. 32.

1880. Crypta monoxyla, Hutton. Man. N.Z. Moll., p. 87.

1880. Crypta unguiformis, Hutton. *Id.*, p. 87.

1883. Crepidula unguiformis, Sowerby. Thes. Conch., vol. v., p. 69, pl. 453, f. 139, 140.

1886. Crepidula monoxyla, Tryon. Man. Conch., vol. viii., p. 128, pl. 37, f. 35, 36.

1886. Crepidula (Janacus) unguiformis, Tryon. *Id.*, p. 130, pl. 39, f. 66.

1887. Crepidula monoxyla, Wilson. V.N., p. 116.

Hab.—Coast generally.

Obs.—When the shell by its form gives evidence of having developed on the outside of another shell, the lamina is imbedded much more deeply, the dorsal portion is brown in colour, and often exhibits a rude series of ridges radiating from the apex, but not present on the nucleus; these features are not discernible when the habitat is inside another shell. Tryon's remarks on C. monoxyla are "this species does not appear to have any special characteristics; a C. unguiformis growing on the outside of a narrow shell would be apt to take on the same form;" from the large series before us we have no doubt that this view is correct and have therefore included it as above.

CREPIDULA IMMERSA, Angas.

1865. Crypta immersa, Angas (non Adams and Reeve). P.Z.S. Lond., p. 57, pl. 2, f. 12, also p. 174, No. 118.

1886. Crepidula immersa, Watson. Chall. Zool., vol. xv., p. 460, No. 4.

1886. Crepidula onyx, Tryon (non Sowerby). Man. Conch., vol. viii., p. 128, pl. 38, f. 46, 47.

1887. Crepidula immersa, Wilson. V.N., p. 116.

Hab.—Port Phillip (J. B. Wilson); off East Moncoeur Island, Bass Strait (Challenger); Puebla Coast.

Obs.—Tryon unites many species as being C. onyx, Sowerby, we cannot follow him.

Family TURRITELLIDÆ.

Genus Turritella, Lamarck, 1799.

TURRITELLA AUSTRALIS, Lamarck.

1839. Turritella australis, Lamarck. Anim. S. Vert. (3rd ed. Deshayes and Edwards), vol. iii., p. 592, No. 12.

1843. Turritella australis, Lamarck. Anim. S. Vert., vol. ix., p. 258.

Turritella australis, Kiener. Icon. Coq. Viv. p. 36, pl. 4, f. 3.

1875. Turritella granulifera, T. Woods. P.R.S. Tas., p. 143.

1886. Turritella (Zaria) australis, Tryon. Man. Conch., vol. viii., p. 207, pl. 65, f. 23.

1897. Turritella (Zaria ?) australis, Kobelt. Conch. Cab., p. 33, pl. 8, f. 5, 6.

Hab.—Gippsland Coast; off Phillip Island, Western Port.

TURRITELLA SPECTRUM, Reeve.

1849. Turritella spectrum, Reeve. Conch. Icon., vol. v., pl. 8, f. 40.

1886. Turritella terebra, var. Tryon. Man. Conch., vol. viii., p. 195, pl. 59, f. 33.

Hab.—Portland (C. M. Maplestone); Portsea (G. B. Pritchard).

Obs.—Only a few very much worn specimens found. It is somewhat doubtful whether the species is indigenous to Victoria.

TURRITELLA OXYACRIS, Tate.

1875. Turritella acuta, T. Woods (non Mayer). P.R.S. Tas., p. 143.

1886. Turritella (Torcula) acuta, Tryon. Man. Conch., vol. viii., p. 206, pl. 64, f. 10.

1897. Turritella (Torcula) acuta, Kobelt. Conch. Cab., p. 56, pl. 18, f. 5.

1897. Turritella oxyacris, Tate. T.R.S., S.A., vol. xxi., p. 41.

Hab.—Dredged alive about 5 fathoms, off Phillip Island, Western Port, by C. J. Gabriel. Cowes (T. S. Hall).

TURRITELLA GUNNI, Reeve.

1849. Turritella gunni, Reeve. Conch. Icon., vol. v., pl. 9, f. 45.

1886. Turritella (Haustator) gunni, Tryon. Man. Conch., vol. viii., p. 203, pl. 63, f. 86.

Hab.—Lorne; Port Albert.

TURRITELLA CLATHRATA, Kiener.

Turritella clathrata, Kiener. Icon. Coq. Viv., p. 33, pl. 14, f. 1.

1849. Turritella clathrata, Reeve. Conch. Icon., vol. v., pl. 8, f. 37.

1886. Turritella (Torcula) clathrata, Tryon. Man. Conch., vol. viii., p. 206, pl. 64, f. 2.

1897. Turritella (Torcula) clathrata, Kobelt. Conch. Cab., p. 26, pl. 7, f. 5.

Hab.—South-west Victorian Coast.

Obs.—Tryon unites with the above T. constricta, Reeve, Conch. Icon., pl. 10, f. 16, but judging from Reeve's figure and description, we are very doubtful as to its being identical.

TURRITELLA RUNCINATA, Watson.

1881. Turritella runcinata, Watson. J.L.S. Lond., vol. xv., p. 218.

1886. Turritella runcinata, Watson. Chall. Zool., vol. xv., p. 475, No. 14, pl. 30, f. 3.

Hab.—Off East Moncoeur Island, Bass Strait, 38 to 40 fathoms, sand and shells (Challenger).

TURRITELLA ACCISA, Watson.

1881. Turritella accisa, Watson. J.L.S. Lond. vol. xv., p. 220.

1886. Turritella accisa, Watson. Chall. Zool., vol. xv., p. 476, No. 15, pl. 30, f. 4.

Hab.—Off East Moncoeur Island, Bass Strait, 38 to 40 fathoms, sand and shells (Challenger).

TURRITELLA LAMELLOSA, Watson.

1881. Turritella lamellosa, Watson. J.L.S. Lond. vol. xv., p. 229.

1886. Turritella lamellosa, Watson. Chall. Zool., vol. xv., p. 474, No. 13, pl. 29, f. 6.

Hab.—Off East Moncoeur Island, Bass Strait, 38 to 40 fathoms, sand and shells (Challenger).

TURRITELLA CORDISMEI, Watson.

1881. Turritella cordismei, Watson. J.L.S. Lond. vol. xv., p. 224.

1886. Turritella cordismei, Watson. Chall. Zool., vol. xv., p. 469, No. 9, pl. 29, f. 1.

Hab.—Off East Moncoeur Island, Bass Strait, 38 to 40 fathoms, sand and shells (Challenger).

TURRITELLA CARLOTTÆ, Watson.

1881. Turritella carlottæ, Watson. J.L.S. Lond. vol. xv., p. 222.

1886. Turritella carlottæ, Watson. Chall. Zool., vol. xv., p. 478, No. 16, pl. 30, f. 5.

Hab.—Off East Moncoeur Island, Bass Strait, 38 to 40 fathoms, sand and shells (Challenger).

TURRITELLA PHILIPPENSIS, Watson.

1881. Turritella philippensis, Watson. J.L.S. Lond., vol. xv., p. 223.

1886. Turritella philippensis, Watson. Chall. Zool., vol. xv., p. 479, No. 17, pl. 30, f. 6.

Hab.—Off entrance to Port Phillip Heads, 33 fathoms, sand (Challenger).

Family VERMETIDÆ.

Genus **Vermetus**, Adanson, 1757.

VERMETUS NOVÆ-HOLLANDIÆ, Rousseau.

Vermetus novæ-hollandiæ, Rousseau. Chenu. Ill. Conch., pl. 1, f. 4*a*.

1886. Vermetus (Thylacodes) novæ-hollandiæ, Tryon. Man. Conch., vol. viii., p. 179, pl. 53, f. 64.

Hab.—Coast generally.

Obs.—Tryon remarks: "Described by Mörch under the name of V. sulcatus, Lam., but one of the three types of that species is a fossil and different, the other two appear to be the V. sipho, Lam." Accepting this as being correct we quote our shell as above, as it is there figured. In the National Museum, before its removal from the University grounds, our shell was exhibited as V. sulcatus, Lamarck, and as having been obtained at Brighton.

Genus **Tenagodes**, Guettard (em.), 1770.

TENAGODES AUSTRALIS, Quoy and Gaimard.

1834. Siliquaria australis, Quoy and Gaimard. Astrolabe, vol. iii., p. 302.

1878. Siliquaria australis, Reeve. Conch. Icon., vol. xx., pl. 2, f. 6.

1880. Siliquaria australis, Hutton. Man. N.Z. Moll., p. 86.

1884. Siliquaria australis, Sowerby. Thes. Conch., vol. v., p. 163, pl. 480, f. 7-8.

1886. Siliquaria (Agathirses) australis, Tryon. Man. Conch., vol. viii., p. 189, pl. 58, f. 20.

Hab.—Western Port; Port Phillip; Puebla coast.

TENAGODES WELDII, T. Woods.

1875. Siliquaria weldii, T. Woods. P.R.S. Tas., p. 144.

1886. Siliquaria (Pyxipoma) weldii, Tryon. Man. Conch., vol. viii., p. 191, pl. 58, f. 28.

Hab.—Port Phillip; Western Port.

Art. XXI.—*On some new Genera and Species of Australian Coleoptera.*

By Rev. T. BLACKBURN, B.A.

[Read 14th December, 1899.]

HISTERIDÆ.

Chlamydopsis.

C. pygidialis, sp. nov. Mas (?). Minus opaca; nigra, antennis pedibusque ferrugineo-testaceis, elytrorum tuberculis basalibus ad apicem læte testaceis; supra crebre sat fortiter, subtus sat grosse, punctulata; setis erectis pallidis sparsissime vestita; capite tuberculis sex biseriatim longitudinaliter instructo; prothorace fortiter transverso, supra depresso valde inæquali, ab apice retrorsum angustato, lateribus et margine antico reflexis dentibus multis armatis; elytris singulis tuberculis singulis basalibus permagnis (his ad apicem testaceis) et subapicalibus minoribus instructis, lateribus antice dentibus 4 magnis armatis; propygidii marginibus lateralibus et postico et linea mediana dentibus magnis serratis; pygidii marginibus lateralibus dentibus minoribus armatis; pedibus valde elongatis; tibiis fortiter compressis, ad apicem oblique truncatis et ad tarsos recipiendos profunde excavatis, apice externo dente magno armato.

Long. $1\frac{1}{2}$ l. Lat. $\frac{4}{5}$ l.

The front margin of the prothorax being very strongly reflexed, its teeth are directed upward; they consist of a large median one which viewed from behind appears to be extremely obtuse (with its outline more or less toothed) and viewed from in front appears subacute (with its outline not at all toothed), and a much smaller tooth on either side of it which appears acute when viewed from either behind or before. The front angle of the prothorax is very strongly defined though scarcely an acute angle; the lateral margin is incised by a deep notch at its middle immediately behind which is a small quadrangular lamina-like projection, behind which the prothorax is abruptly narrower in the short interval to the base. The base is strongly and

widely lobed in the middle. On the disc of the prothorax a very strong carina runs back from the summit of the median tooth on the front margin for half the length of the prothorax, and a strong carina runs forward on either side from the outer extremity of the basal lobe to a point a little outside the hind extremity of the anterior carina, each end of these oblique carinæ being elevated with a distinct sharp tooth. This species can be at once distinguished from all its previously described congeners by the extraordinary sculpture of its prothorax pygidium and propygidium. Its legs are of similar structure to those of the type of *C. inæqualis*, Blackb., which probably indicates that it is a male. It was obtained by beating dead branches and is probably connected with some species of *Hymenoptera* inhabiting the dead wood.

Victoria; near Fernshaw.

PECTINICORNES.

MASTOCHILUS.

Several of the names that stand in Masters' Catalogue under the heading of this genus are not capable of reliable identification without examination of types, viz., *Australasicus*, Perch., *nitidulus*, Macl., *polyphyllus*, W. S. Macl., *puncticollis*, Macl., and *rugiceps*, Reiche. I have been able to examine the original type of *polyphyllus*, and can say that it is identical with the species to which Burmeister attributes the name. From Burmeister's remarks on *australasicus* I am afraid that insect must be regarded as scarcely likely to be identified with certainty; I propose therefore to describe an insect which I believe to be that to which Percheron applied the name. I think I know Sir W. Macleay's two species, but as I have not seen the original types I shall abstain at present from saying more than that is probable they represent valid species. *Rugiceps*, Reiche, is quite hopeless; it is uncertain even whether it is a *Mastochilus*. In Masters' Catalogue *Passalus Lottini*, Boisd., appears as an *Eriocnemis*, but I can find no sufficient reason for considering that to be its proper place; certainly the original description is useless, giving no information concerning the size or habitat (except "New Holland") or as to the

sculpture of the head or the number of joints in the antennal flabellum, no information in fact on which it could be assigned definitely to any of the genera recognised in Masters' Catalogue. The only two characters mentioned by Boisduval that enable it to be said of any Australian *Passalid* that it is not *Lottini* are the presence of a median impressed line on the prothorax (there are very few Australian species which have not at any rate a *faint* median line), and that indicated by calling the striæ of the elytra "læves." I know of no Australian *Passalid* in which all the elytral striæ are impunctulate, but probably Boisduval's expression refers only to the *dorsal* striæ (which are impunctulate or nearly so in many species), and this view of the matter is strengthened by the fact that the only other Australian *Passalides* described by Boisduval have their *dorsal* elytral striæ more or less punctulate. Burmeister increases the difficulty by saying that there is an example of *Lottini* in Dupont's collection, giving the size as 24 l., and then proceeding to imply that he had not seen *Lottini* by conjecturing that its antennal flabellum is likely to be 6-jointed, because it is 6-jointed in the species that follows *Lottini* in Boisduval's descriptions. The only other author that I can find referring to *Lottini* is Kaup, who in a note on *Plesthenus quadricornis*, says that the latter insect is named *Lottini*, Boisd. in Mniszech's collection, and that it is impossible to express an opinion as to whether it is or is not correctly so named. Under these circumstances the only course practicable is to treat the name *Lottini* as though it were non-existent, until some further information is forthcoming. There have been a considerable number of synonyms bestowed on the species of *Mastochilus*, most of which are duly recorded in Master's Catalogue, but one very obvious case of synonymy seems to have escaped notice hitherto, viz., *M. impressicollis*, Bohem. =*polyphyllus*, W. S. Macl., the latter being much the older name. Thus there are at present 6 names (and 6 only), that it seems practicable to regard as representing valid species of *Mastochilus*, and I propose in the following pages to re-describe one of them, and to add the description of a new one.

The following table shows the distinctive characters of the species known to me:—

A.—Species not having a continuous sharply defined longitudinal sulcus on the prothorax.

B.—Front declivity of shoulder not asperate and pilose.

C.—All the elytral interstices wider than the striæ.

D.—The distance between the pair of tubercles behind the base of the clypeus, not more than half the width of the labrum - - capitalis, Blackb.

DD.—The distance between those tubercles scarcely less than the whole width of the labrum australasicus, Blackb.

CC.—The lateral interstices of the elytra not wider than the adjacent striæ - dilatatus, Dalm.

BB.—Front declivity of shoulder asperate and pilose - - - - - - politus, Burm.

AA.—A well defined continuous longitudinal sulcus (about as deep and wide as the elytral striæ) on prothorax - polyphyllus, W. S. Macl.

M. capitalis, sp. nov. Minus depressus; nitidus; ater, abdomine supra ferrugineo; pygidio, labro, prosterno ad latera, antennis pedibusque, pilis fulvis plus minusve crebre vestitis; labro antice leviter (fere ut *M. dilatati*, Dalm.) emarginato, fere symmetrico, grosse sat sparsim punctulato, sat nitido; clypeo minus nitido, minus perspicue punctulato, longitudinaliter inæqualiter rugato, utrinque ut dens magnus conicus producto; capitis partibus depressis minus (elevatis magis) nitidis, vix perspicue punctulatis sed grosse vermiculato-rugulosis; capite postice (ad partis excavatæ basin) tuberculo elongato transverso (hoc in medio antrorsum producto fortiter dentiformi) et ante hunc tuberculo laminiformi sat anguste bifido armato; antennis sat elongatis, flabello 6-articulato (articulis gradatim longioribus, quam *M. politi*, Burm. multo longioribus); prothorace fere lævi, antice sat fortiter sinuato vix emarginato linea mediana subtilissima longitudinali (hac antice et postice omnino deleta) impresso, utrinque pone medium fovea magna profunda (hac in fundo punctulata)

instructo; elytris fortiter striatis, striis dorsalibus fere (præsertim in parte antica) lævibus, striis lateralibus sat fortiter crenulatis, sed pare crenulata quam interstitia manifeste angustiori, interstitiis dorsalibus latis planis (lateralibus minus latis sat convexis). Long. 24 l. Lat. 8 l.

Easily distinguishable from all the other *Mastochili* known to me by *inter alia* the pair of tubercles immediately behind the clypeus (and projecting over it) being much larger and more conspicuous than any other elevation (except the one at the middle of the base of the excavated area of the head), and being placed so near each other that the interval between them is not more than half the width of the labrum and that they appear as the produced corners of a single lamina rather than as distinct tubercles.

It is possible that this species is (*Passalus*) *Lottini*, Boisd.; but certainly not if that species is identical (as Kaup conjectures) with *Plesthenus quadricornis*, nor if that species is correctly placed (as in Masters' Catalogue) in *Eriocnemis*, nor if it has (as Burmeister supposes) a well defined deep longitudinal prothoracic canalicula.

It should be noted that although the rest of the head is perfectly symmetrical the labrum and mandibles are not quite so, the left side of the former being slightly more prominent than the right, and the left mandible (as usual in the Australian *Mastochili*) a trifle longer than the right.

N. S. Wales; Richmond R. District.

M. australasicus (? Perch). Modice depressus; nitidus; ater, abdomine supra ferrugineo; pygidio, labro, prosterno ad latera, antennis pedibusque, pilis fulvis plus minusve crebre vestitis; labro antice leviter emarginato, symmetrico, grosse minus crebre punctulato, sat nitido; clypeo sat nitido, minus perspicue punctulato, sat crebre ruguloso, utrinque ut dens magnus conicus producto, capitis partibus depressis crebre vix grosse rugulosis; capite postice (ad partis excavatæ basin) tuberculo elongato transverso (hoc in medio fortiter antrorsum producto dentiformi) et ante hunc carina transversa arcuata (hac quam labrum vix angustiori et utrinque tuberculo parvo dentiformi terminata) armato, tuberculis ad carinæ arcuatæ extremitates carina subtili recta conjunctis; antennis ut *M. capitalis;* pro-

thorace fere ut *M. capitalis* sed antice vix sinuato et linea mediana longitudinali ad basin continue perspicua; elytris fere ut *M. capitalis*, sed striis 3ª et 4ª perspicue crenulatis.

Long. 20-22 l. Lat. $7\frac{1}{4}$–$7\frac{1}{2}$ l.

Rather close to the preceeding but more depressed, the labrum symmetrical, the fine line on the prothorax more distinct and continuous to the base, the dorsal striæ of the elytra more distinctly crenulate, and especially the head very differently sculptured; the projection resembling a bifid lamina being replaced by an arched carina which terminates in a tubercle at each end these tubercles being connected by a fine straight carina and the interval between them being scarcely less than the width of the labrum. This head sculpture is not unlike that of *M. politus*, Burm. and *M. dilatatus*, Dalm., from both of which the present species differs by the much longer joints of its antennal flabellum and much larger size, while it differs *inter alia* from the former also by its not being pilose on the front extero-anterior declivity of its elytra and from the latter by the much wider lateral interstices of its elytra and its pilose labrum.

Queensland.

LAMELLICORNES.

PANELUS (gen. Copridarum).

P. Arthuri, sp. nov. Brevis; latus; nitidus; piceus, pedibus dilutioribus; capite magno, minus crebre minus subtiliter punctulato, antice sat fortiter depresso et in medio dentibus 2 acutis armato, inter dentes fortiter emarginato; prothorace fere ut caput punctulato, quam longiori circiter duplo latiori, antice subito angustato, angulis anticis subacutis posticis obtusis; elytris modice convexis, 7-striatis, interstitiis vix manifeste punctulatis; tibiis compressis, leviter arcuatis; tarsis compressis.

Long. 1 l. Lat. $\frac{7}{10}$ l.

This interesting little species has been sent to me by Mr. A. M. Lea, who has also given me a specimen of *P. parvulus*, Waterh., the type of the genus (which he tells me he received from Mr. Lewis). The present insect is very much like *P. parvulus*, but differs from it *inter alia* by its somewhat less convex form and less strongly arcuate tibiæ, as well as by the considerably stronger puncturation of its head and the stronger

median teeth of its clypeus, between which the front margin is more deeply emarginate. The genus *Panelus* is new to Australia, and is a member of Lacordaire's "Groupe" *Minthophilides.*

It is just possible that this is the species on which Sir W. Macleay founded his name *Temnoplectron pygmæum*, the description of which is too brief for certain identification. Sir W. Macleay, however, says of that insect, "disk of prothorax very minutely punctate," a statement which *inter alia* does not apply satisfactorily to the present species.

N.W. Australia (Macleay Museum).

CHEIROPLATYS.

C. inermis, sp. nov. Sat late subovatus; modice nitidus; piceus vel rufo-piceus, corpore subtus pedibusque rufescentibus; sternis pedibusque pilosis; clypeo transversim ruguloso, antice truncato, lateribus sat rectis obliquis; fronte a clypeo per carinam leviter arcuatam divisa, ut clypeus transversim rugulosa; prothorace quam longiori fere sesquilatiori, longitudinaliter leviter canaliculato, subtilius sparsius (antice magis crebre) punctulato, antice leviter impresso et tuberculo obsoleto instructo, ad basin haud marginato, antice sat angustato, angulis anticis subacutis posticis rotundato-obtusis; scutello sat lævi, elytris stria subsuturali sat profunda et puncturarum seriebus 8 (his per paria, vix manifeste in striis, dispositis) impressis, seriebus externis minus distinctis, pari 2° (a sutura enumerato) quam cetera breviori, puncturis basin versus sat magnis sat profunde impressis postice gradatim subtilioribus, interstitiis inter paria puncturis (his serierum puncturis sat similibus) confuse impressis; pygidio fere ut prothoracis discus punctulato; tibiis anticis modice dilatatis, obtuse tridentatis; vel profunde trisinuatis.

Maris pygidio fortiter gibbo, feminæ leviter convexo.

Long. 9-9$\frac{1}{2}$ l. Lat. 5-5$\frac{1}{2}$ l.

In respect of form and sculpture this species is very close to *C. mælius*, Er., but differs from it in the base of its prothorax not being margined; also in the median channel of that segment being more strongly defined and the impression near the front margin being feebler and less transverse, the latter appearing as little more than a deepening of the median channel rather than a

distinct feature in the sculpture. The place of *C. inermis* in the tabulation of species of this genus which I furnished to the Roy. Soc. S.A. (1896, p. 243) is beside *C. pygmæus*, Blackb., from which it is at once distinguishable by the puncturation of its pygidium not being notably closer and coarser than that of its prothorax.

Victoria; taken by myself and sent by Messrs. Sloane, Mulder, etc.

C. mælius, Er. Since I wrote the paper referred to above (Tr. R.S. S.A., 1896) I have received more specimens from Tasmania of the species that I had some hesitation in referring to *C. mælius*, Er., and I am now satisfied that it is correctly called by that name.

ELATERIDÆ (?).

ECHTHROGASTER (gen. nov. Campylidarum ?).

Palporum maxillarium articulus apicalis elongato-obconicus; mandibula porrecta curvata ad apicem acuta; caput modicum, utrinque ad clypei (hoc a fronte haud sutura definito) basin profunde emarginatum; clypeus frontis curvam haud continuans sed sat abrupte deflectus, profunde concavus antice rotundatus; labrum inconspicuum; oculi modici, sat convexi, integri, subtiliter granulati a prothorace longe distantes; antennæ ad basin abdominis attingentes, filiformes, sat robusti, articulis 1° crasso piriformi elongato (pone oculum medium attingenti 2° parvo (ante 1i apicem inserto) 3° quam 1us vix breviori 4° quam 3us paullo breviori 4° – 10° inter se sat similibus 11° quam 1us haud breviori; prothorax tranversim subquadratus, antice leviter angustatus, obsolete inæqualis, lateribus leviter arcuatis, margine antico fere truncato, basi vix sinuata, angulis anticis obtusis posticis acutis leviter divergentibus vix retrorsum productis; elytra quam prothorax circiter quarta parte latiora circiter quadruplo longiora, a basi ad apicem gradatim leviter angustata, punctulato-striata, epipleuris concavis pone medium angustis; prosternum sat convexum, æquale, ante coxas elongatum, suturis prosternalibus rectis antrorsum divergentibus, parte mediana pone coxas deflectum; mesosternum longitudinaliter excavatum; metasternum inter coxas intermedias acute productum, episternis

sat angustis sat parallelis; coxæ anticæ globuli haud prominentes, intermediæ subcontiguæ, posticæ laminiformes ad partem interiorem latæ extrorsum gradatim sinuatim angustiores; pedes modici; tarsi quam tibiæ parum breviores, subtus pubescentes, leviter compressi, posticorum articulis 1° quam 2^{us} vix longiori 2° quam 3^{us} et 3° quam 4^{us} paullo longioribus omnibus simplicibus; unguiculis appendiculatis; segmenta ventralia 2° et 3° utrinque profunde late longitudinaliter excavata.

The insect for which I propose this new name is an extremely remarkable one, combining in the most perplexing manner the characters of the *Elateridæ* and *Eucnemidæ* with a facies different from that of a typical member of either family and somewhat suggestive (as regards head prothorax and elytra viewed from above) of *Tenebrionid* genera (*e.g. Docalis* or *Exangeltus*). Its metasternum sharply pointed between the intermediate coxæ, its head with the clypeus not continuing the convexity of the general surface and its porrect mandibles seem to forbid its being referred to the *Eucnemidæ*. The absence of a prosternal "chin-piece" limits it to the *Campylides* if it is an *Elaterid.* Its slender *tibiæ* are *inter alia multa* inconsistent with the idea of its being a *Cebrionid.* I have considered the possibility of its being a very aberrant *Dascyllid*—the *Dascyllidæ* of Lacordaire including some very diverse forms. In that family there is no place that can be thought of as possible for this insect unless in the neighbourhood of *Stenocolus* and several allied genera which I have not seen, and I think the absence of a distinctly visible labrum as well as the form of the head (which is almost *Eucnemid* in shape) will alone suffice to preclude association with the *Dascyllidæ.* Turning to the *Campylides* I find no structural character absolutely irreconcilable with the present species. The absence of a distinct labrum is no doubt anomalous, but M. Lacordaire mentions one *Campylid* genus (*Plastocerus*) in which he thinks the labrum is wanting—although M. Candèze asserts it to be present but very inconspicuous. The form of the head appears to me at most an exaggeration of forms described by M. Lacordaire as exhibited by some *Campylid* genera and is perhaps to be expected to accompany the disappearance of the labrum. The antennæ (robust long and filiform, with the 2nd joint attached to the basal one on the under surface, slightly behind the apex

of the latter) are very *Eucnemid* in appearance. The form of the prothorax (with the base nearly straight and the hind angles not produced hindward and only feebly produced outward) is unlike the form in any genus known to me in any family in which the structural characters in general are not totally different from those of the present species. As far as the *recognition* of the insect is concerned there can be no difficulty on account of its porrect arched mandibles together enclosing a void space; in combination with the extraordinary structure of the abdomen (at any rate in one sex), there being on either side a wide and deep excavation very minutely punctulate—in strong constrast to the coarse puncturation of the rest of the surface—running from the base of the 2nd segment to the apex of the 3rd segment.

I dug this curious insect out of the decayed stump of a tree many years since, and cut the stump to pieces without finding another specimen, so its habitat may have been accidental. I have never met with another example since, nor have I seen anything like it in any collection.

E. lugubris, sp. nov. Piceo-niger, antennis tarsisque subrufescentibus; opacus; setis brevibus pallidis sparsim vestitus; capite crebre sat fortiter rugulose punctulato; prothorace sat fortiter transverso, subinæquali, subtilius creberrime aspere punctulato; elytris crebre sat fortiter punctulato-striatis, interstitiis angustis transversim rugulosis; corpore subtus pedibusque sat rugulose punctulatis.

Long. 4l. Lat. 1l.

S. Australia (Eyre's Peninsula).

EUCNEMIDÆ.

As I furnish, below, the diagnoses of three new genera of this family and I cannot find that any tabulated exposition of the characters of the Australian *Eucnemid* genera has been hitherto published (except in so far as they find a place in M. de Bonvouloir's work on the *Eucnemidæ* of the world), it seems desirable here to provide a tabulation of that description showing the relation of the new genera to those previously known, and using in the main the characters relied upon by M. de Bonvouloir.

A.—Antennæ in repose lying in deep prosternal sulci.
  B.—Basal part of metasternum bearing a short longitudinal sulcus.
    C.—Prosternal sulcus closed behind - - - Arisus.
    CC.—Prosternal sulcus open behind Dyscharachthis (nov. gen.)
  BB.—Metasternum devoid of sulci.
    C.—Prosternal sulcus not narrowed by the eye in passing on to the head.
      D.—Prosternal sulcus about as wide as the distance from its inner margin to the prosternal suture - - - Anabolus.
      DD.—Prosternal sulcus much narrower - Dromæolus.
    CC.—Prosternal sulcus narrowed by the eye in passing on to the head.
      D.—Prosternal sulcus margined within by a continuous elevated line.
        E.—Joint 4 of tarsi produced beneath.
          F.—Prosternal sulcus as wide as the distance from its inner margin to the prosternal suture - Galbodema.
          FF.—Prosternal sulcus notably less wide.
            G.—Basal joint of hind tarsi as long as all the other joints together - - - - - Fornax.
            GG.—Basal joint of hind tarsi notably shorter - Discaptothorax (nov. gen.)
        EE.—Joint 4 of tarsi not produced beneath - - - - Phænocerus.
      DD.—Prosternal sulcus margined within by an elevated line only in its hinder part - Dystrigonisthis (nov. gen.)
AA.—Antennæ not received into prosternal sulci.
  B.—Disc of pronotum bearing (at least near base) a supplemental carina near the lateral edging.

C.—Joints 2 and 3 of antennæ together much longer than the 4th joint - Microrhagus.
CC.—Joints 2 and 3 of antennæ (3 excessively minute) together much shorter than the 4th joint - Entomophthalmus.
BB.—Disc of pronotum devoid of carinæ.
C.—Hind outline of mandibles strongly sinuous.
D.—Apex of apical ventral segment produced in a short narrow process.
E.—Episterna of metasternum parallel Nematodes.
EE. — Episterna of metasternum narrowing towards front - - Trigonopleurus.
DD.—Apex of apical ventral segment not produced - - - - Hypocœlus.
CC.—Hind outline of mandibles straight or nearly so.
D.—Joint 4 of tarsi produced beneath - - Eumenes.
DD.—Joint 4 of tarsi not produced beneath.
E.—Clypeus strongly narrowed at base.
F.—Antennal joints gradually and continuously longer from 4th joint Orodotes.
FF.—Antennal joints notably elongated only from 9th joint - Dyscolocerus.
EE.—Clypeus very feebly narrowed at base Lycaon.

DYSCHARACHTHIS (gen. nov. Eucnemidarum).

Corpus breve, sat latum, postice obtuse angustatum; clypeus ad basin sat angustatus, a fronte linea subtilissima continua (hac contorta ut litteram w simulat) divisus, antice sat rotundatus; frons longitudinaliter carinata; mandibula minus rugulosa, postice fere recta; antennæ sat breves (prothoracem vix superantes), filiformes, sat robustæ, articulo 3$^{o.}$ quam 4$^{us.}$ multo longiori; pronotum transversum, antrorsum a basi arcuatim parum fortiter angustatum, ad basin fortiter bisinuatum, lobo mediano (hoc a pronoto sulco recto transverso insigni diviso) lato bene definito, angulis posticis acutis nullo modo divaricatis; suturæ prosternales manifeste impressæ rectæ; sulci prosternales marginales profundi sat lati (sed quam basis trianguli propleuralis

circiter duplo angustiores), postice aperti, in capite haud angustati; triangulus propleuralis fere æquilaterus (latere externo quam cetera vix longiori), metasternum antice utrinque prope coxas intermedias sulco brevi longitudinali minus perspicuo impressum; lamina coxarum posticarum in parte basali lata (hic angulata et extrorsum gradatim angustata); episterna meta thoracica angusta subparallela sed retrorsum a basi gradatim leviter dilatata; segmenta ventralia normalia nec ad tarsos recipiendos sulcata; pedes modici; femora sat compressa tarsi filiformes, articulo 4° subtus vix producto; tarsorum posticorum articulo basali quam ceteri conjuncti multo breviori; unguiculi exigui, ad basin compressi.

The extremely small *Eucnemid* for which I propose this new generic name cannot find a place in any genus that I can ascertain to have been previously characterised. In M. de Bonvouloir's tabulation of the *Eucnemid* genera, and also by the scheme of classification developed in the body of his memoir (Ann. Soc. Ent. Fr. 1870-75) the present genus would stand near the South American genus *Lamprotrichus* which is very imperfectly characterized (owing, in part at least, to the type being mutilated). It differs however *inter alia* in the apical ventral segment not being prolonged at the apex and in the presence of a frontal carina (characters M. de Bonvouloir regards as generic), and apparently has no superficial resemblance at all to the unique species of *Lamprotrichus* which is a very large *Eucnemid* of elongate form marked on its prothorax and elytra with a pattern resulting from dense pubesence varied with glabrous impunctulate patches. It differs from nearly all other *Eucnemid* genera by the presence of basal metasternal sulci. This sulcus is found on one other Australian genus (Arisus), which, however, *inter alia* has the 4th joint of its tarsi excavate-emarginate above and somewhat prolonged beneath. The form of the line (on the head) which M. de Bonvouloir calls the "interocular carina" (and which is angularly zigzagged hindward in the middle in this insect) and of the basal lobe of the prothorax (which appears to be almost a distinct piece cut off by a deep suture from the rest of the prothorax) are very notable characters. The 4th joint of the tarsi is almost imperceptibly produced beneath but I cannot find it to be at all excavate above.

D. brevipennis, sp. nov. Piceo-brunneus, elytris paullo dilutioribus, antennis pedibusque ferrugineis; sat dense fulvo-pubescens; elytris quam prothorax minus quam duplo longioribus, nec latioribus; capite prothoraceque crebre subtiliter subaspere punctulatis; elytris manifeste striatis, interstitiis crebre fortiter (fere crasse) subrugulose punctulatis; antennarum articulis 1° modico, 2° brevi 3° quam 2^{us} duplo longiori, 4° 2° æquali, 5° 2° æquali, 6°-7° que parum longioribus fere transversis, 8°-10° quam 7^{us} parum longioribus, 11° quam 10^{us} duplo longiori.

Long. $1\frac{4}{5}$ l. Lat. $\frac{4}{5}$ l.

DROMÆOLUS.

At the request of Mr. A. M. Lea, of Hobart, Tasmania, I take this opportunity of drawing attention to the fact that two species described by that gentlemen and referred to this genus (Proc. L.S. N.S.W., 1891) ought to have been otherwise disposed, as I have observed them to be members of the *inter se* very closely allied genera *Trigonopleurus* and *Nematodes*, as follows:—

D. nigricollis, Lea = *Trigonopleurus rugulosus*, Bonv.

D. thoracicus, Lea = *Nematodes thoracicus*, Lea.

S. Australia (Basin of Lake Eyre).

DISCAPTOTHORAX (gen. nov. Eucnemidarum.)

Corpus sat cylindricum sat angustum; clypeus ad basin modice angustatus antice fortiter sinuatus, carina interoculari haud continua; frons haud carinata; mandibula sat rugulosa, postice retrorsum sat fortiter producta; antennæ filiformes sat elongatæ (abdominis basin fere attingentes), modice robustæ, articulo 3° quam 4^{us} paullo longiori; pronotum leviter transversum ad basin profunde bisinuatum, lateribus fere rectis prope marginem anticum (hoc quam basis parum angustiori) leviter dilatato-rotundatis, angulis posticis vix acutis nullo modo divaricatis; suturæ prosternales bene definitæ, leviter arcuatæ; sulci prosternales profundi lati (margine externo in parte antica carinis 2 parallelis fere contiguis instructo), quam trianguli propleuralis basis manifeste nec multo angustiores, postice aperti, in capite angustati; trianguli propleuralis margo posticus quam ceteri (his inter se sat æqualibus) circiter dimidia parte brevior; metasternum abdomenque, sulcis carentia; coxarum posticarum lamina in parte basali lata (hac

angulata et extrorsum gradatim valde angustata); pedes sat elongati; tarsorum articulus 4^{us} supra obsolete excavato-emarginatus, subtus perspicue productus; tarsorum posticorum articulus basalis quam ceteri conjuncti paullo brevior.

I cannot place the insect for which I propose this name in any previously characterised genus. Its facies is somewhat like that of *Galbodema* but its structural characters are different. Its non-sulcate metasternum and abdomen, non-lamellated tarsi, hind-coxal lamellæ strongly narrowed towards the lateral margin of the body, antennæ received in deep sulci between the propleural triangle and the margin of the pronotum (which sulci become much narrowed on the head and are distinctly separated from the propleural triangle by a continuous raised line), 4th tarsal joint not simple, and elongate filiform antennæ, place it (in M. de Bonvouloir's tabulation, *loc. cit.*) in the group of nine genera beginning with "No. 36" and ending with "No. 41." Among those genera the present one may be easily recognised by the following characters in combination:—prosternal sulci much more than half as wide as the base of the propleural triangle, antennæ quite simple 3rd antennal joint very distinctly longer than 4th, elytral epipleuræ becoming very narrow before the middle, apex of clypeus very strongly sinuous, and (especially) the unusual structure of the lateral edging of the pronotum which (in nearly its whole length) consists of two fine elevated lines with a very narrow convexity between them and which consequently is similar to the epipleuræ of the elytra about their middle. I think this genus may stand next to *Galbodema* from which its simple antennæ, narrower prosternal sulci, and bicarinate edging of pronotum furnish *inter alia* abundant distinctive characters.

D. Koebelei, sp. nov. Supra ferrugineo-brunneus, corpore subtus antennis pedibusque dilutioribus; breviter sat dense fulvo-pubescens; capite prothoraceque crebre sat fortiter rugulose punctulatis; elytris subfortiter striatis, interstitiis crebre subfortiter rugulose (quam prothorax paullo miuus rugulose) punctulatis; antennarum articulis 1° robusto sat brevi (oculum medium attingenti), 2° brevi, 3° quam 1^{us} vix breviori, 4° quam 3^{us} manifeste breviori, 4°-6° inter se sat æqualibus 7°-11° manifeste longioribus (inter se subæqualibus).

Long. 3-4 l. Lat. 1-1$\frac{1}{5}$ l.

In one of the two specimens before me the antennæ are a trifle shorter than in the one described, owing to the last five joints,—and especially the 7th joint,—being less elongated. This is probably a sexual difference. There is a small but distinct impression on the prothorax on either side of the middle line a little in front of the base of the segment.

N. Queensland; given to me by Mr. Koebele.

DYSTRIGONISTHIS (gen. nov. *Eucnemidarum*).

Corpus minus angustum, postice obtuse angustatum; clypeus ad basin parum angustatus, antice rotundatus; carina interocularis haud continua; frons haud carinata; mandibula modice rugulosa, postice sat recta; antennæ minus elongatæ, fortiter dentatæ, articulo 3° quam 4^{us} sat breviori; pronotum sat transversum, a basi ad apicem arcuatim angustatum, ad basin leviter bisinuatum, angulis posticis minus acutis nullo modo divaricatis; suturæ prosternales vix plane rectæ, antice apertæ; sulci prosternales profundi sat angusti (quam trianguli propleuralis basis quater angustiores, postice clausi, in capite angusti; trianguli propleuralis margo posticus quam externus vix (quam internus circiter duplo, hoc in parte postica solum carinato) longior; metasternum abdomenque sulcis carentia; coxarum posticarum lamina in parte basali lata, extrorsum leviter angustata (sicut ad marginem lateralem longior est quam metasterni dimidia pars); pedes minus elongatæ; tarsorum articulus 4^{us} supra leviter excavato-emarginatus, subtus perspicue productus; tarsorum posticorum articulus basalis ceteris conjunctis longitudine subæqualibus.

This is a very remarkable genus presenting a character that prevents its falling into any of the smaller aggregates of M. de Bonvouloir's tabulation of *Eucnemid* genera. The form of its prosternal sutures and hind-coxal lamellæ, the absence of metasternal and abdominal sulci, its non-lamellate tarsi, and the presence of a deep prosternal sulcus (which is narrowed on the head), refer it to the large group beginning with *Seython* and ending with *Eucalodemas*. But M. de Bonvouloir divides this group into three sections according as the prosternal sulcus is (*a*) shallow, and confused with the propleural triangle (*b*) deep and distinct but not separated from the propleural triangle by a

carina (*c*) separated from the propleural triangle by a continuous carina. In the insect before me the prosternal sulcus is bordered on its inner side by a strong carina which extends from its hind apex for a considerable distance but disappears at about the middle of the length of the propleural triangle. Moreover the propleural triangle itself is extremely short and does not extend as far forward as the prosternum does, so that the front part of the sulcus is bordered on its inner side (not by the propleural triangle but) by the prosternum. The form of the hind-coxal laminæ is also unusual; they are very wide at their inner end and only feebly (though very decidedly) narrowed towards the lateral margin, so that on the lateral margin they occupy more than a third part of the distance from the front of the metasternum to their own hind margin.

D. paradoxus, sp. nov. Obscure brunneus antennis pedibusque dilutioribus; fulvo-pubescens; capite prothoraceque crebre subtilius subaspere punctulatis; elytris leviter striatis, striis postice et latera versus linea subtili elevata marginatis, interstitiis fere ut prothorax (sed paullo minus crebre paullo minus aspere) punctulatis; antennarum prothoracem vix superantium articulis 1° circiter ad oculum medium attingenti, 2° perparvo, 3° quam 1[i] dimidium vix longiori leviter compresso obconico, 4°-5° que magis compressis sat dentiformibus quam 3[us] perspicue longioribus, 6°-10° inter se sat æqualibus quam 5[us] brevioribus fortiter compressis fortiter dentiformibus, 11° elongato-ovali quam pracedentes 2 conjuncti vix breviori.

Long. $3\frac{1}{3}$ l. Lat. $1\frac{1}{5}$ l.

In joints 6-10 of the antennæ the apical and internal sides are of about the same length, the hind side is about $\frac{2}{3}$ of the length of either of the other sides.

N. Queensland. (Mr. Cowley).

MICRORHAGUS.

M. cairnesensis, sp. nov. Elongatus, subparallelus, postice leviter attenuatus; nigropiceus antennis pedibus sutura metasternoque dilutioribus; pube griseo vestitus; capite crebre rugulose minus subtiliter punctulato, haud carinato, longitudinaliter late leviter impresso; clypeo ad basin minus fortiter angustato, quam carinæ interocularis longitudo manifeste latiori; antennis quam corporis

dimidium (maris vix, feminæ perspicue) brevioribus; articulis 1° ad oculum medium attingenti, 2° parvo, 3° cum 2° 1um æquanti, 4° quam 3us parum breviori, 4°-10° gradatim paullo longioribus, 11° quam 9us 10us que conjuncti vix breviori; articulis (basalibus exceptis) ramos singulos graciles elongatos ad apicem emittentibus; pronoto leviter transverso, ut caput punctulato, ante scutellum longitudinaliter breviter carinato, inæquali (in discum medium late leviter, utrinque prope carinam antescutellarem oblique leviter, utrinque inter depressionem mediam communem et marginem lateralem fovea parva rotundata, impresso), antice vix angustato, lateribus sat rectis, basi fortiter bisinuata, carinis intramarginalibus et antica et postica brevibus; elytris manifeste striatis, interstitiis vix planis minus crebre sat fortiter punctulatis; depressione juxta-suturali prosterni lævi nitida, postice latiori, utrinque et postice linea continua marginata; processu intercoxali prosterni postice deflexo; metasterni episternis angustis parallelis.

Maris antennarum articulis 3°-10° ramos graciles emittentibus, 3i-6i ramis gradatim longioribus, 6i-10i ramis sat æqualibus quam articulus duplo longioribus; segmento ventrali penultimo fovea rotundata parva profunda instructo, hac linea elevata tenui circumcincta.

Feminæ antennarum articulis 3° ad apicem intus fortiter angulato, 4°-10° ramos emittentibus, his quam maris paullo minus elongatis minus gracilibus.

Long. 4 l. Lat. $1\frac{1}{5}$ l.

This very large and fine *Microrhagus* is perhaps near *Sahlbergi*, Mannerh., and *impressicollis*, Bonv., on account of the presence of a median fovea on the penultimate ventral segment as well as its large size. In the present insect the fovea is unquestionably sexual, but M. de Bonvouloir implies that in those species it is not so. If he was in error in that opinion the error upsets the value of his tabulation of the species of the genus. Disregarding the ventral foveæ this species seems to fall in M. de Bonvouloir's tabulation near *M. suturalis*, Bonv. (an Australian species) but to differ from it *inter alia multa* by the strongly rugulose puncturation of its head and its pectinate antennæ.

N. Queensland; sent to me by Mr. Cowley.

Entomophthalmus.

E. uniformis, sp. nov. Sat elongatus, subparallelus, postice leviter angustatus, minus convexus; tota rufo-ferrugineus; capite crebre aspere punctulato; oculis subobsolete incisis; antennis quam corporis dimidium multo longioribus, apicem versus paullo magis gracilibus; prothorace sat fortiter tranverso, quadriformi, crebre vix aspere punctulato, carina accessa bene definita; elytris obsoletissime striatis, crebre subfortiter (quam prothorax magis fortiter) punctulatis.

Long. $1\frac{1}{2}$ l. Lat. $\frac{1}{2}$ l (vix).

The genus *Entomophthalmus* has not been previously recorded as Australian. The present species is near the Malayan *E. fugax*, Bonv., with which it agrees in the feebleness of the incision of its eyes, but is *inter alia* quite differently coloured.

N. Queensland (Mr. Koebele).

Dyscolocerus.

The following species are certainly, I think, congeneric with the insect that I described (Tr. Roy. Soc. S.A., 1892, p. 56) as *D. heros*, Blackb. M. de Bonvouloir treats the length of the 9th antennal joint in relation to that of the preceding joints as a generic character, but it appears to me that the character cannot be strictly insisted upon. In the species before me the 9th joint is strongly elongated but not so strongly as it is said to be in the diagnosis of *Dyscolocerus* (in *heros* it is *more* strongly elongated than according to the diagnosis it should be). I cannot find any other character on which to separate any of these Australian forms from *Dyscolocerus*. The following characters in combination distinguish the insects described below from all the *Eucnemid* genera known to me except *Namobius Dyscolocerus Cryptostoma* and *Orodotes*;—viz, metasternum and abdomen non-sulcate, no sulci for receiving the antennæ on any part of the prosternum, all the joints of the tarsi quite simple, laminæ of the hind coxæ continuously and gradually narrowed from their hind apex to the lateral magin, no discal carinæ on the pronotum, mandibles straight (or nearly so) behind, clypeus rounded in front and considerably narrowed at its base, antennæ not in the least dentate or pectinate, propleuri strongly narrowed in front. The four genera mentioned above as presenting this combination of

characters are chiefly distinguished by M. de Bonvouloir *inter se* by antennal differences; of them *Namobius* and *Cryptostoma* are American genera whose antennal structure is very different indeed from that of *Dyscolocerus*. *Orodotes* is an Australian genus distinguished from *Dyscolocerus* by its propleuri being "notably dilated on the external side" (a character I cannot find in the insects before me) and its antennal joints gradually elongating from the 4th (not, as in *Dyscolocerus* suddenly from the 9th). The unique species (*O. Jansoni*, Bonv.), moreover appears to be extremely unlike the following two species in its superficial characters. This leaves only *Dycolocerus*, with the diagnosis of which the following two species (and *D. heros*) would agree quite satisfactorily if the antennæ were characterised as having the 9th and following joints merely "all much longer than any of the preceeding 5 which are subequal;" but M. de Bonvouloir adds as a generic character "9th joint (alone) subequal to the preceeding 5 together," which is not the case with any of the Australian species I attribute to *Dyscolocerus*.

D. concolor, sp. nov. Sat elongatus, sat convexus, postice attenuatus; læte ferrugineus; pube fulva sat dense vestitus; capite crebre minus fortiter vix rugulose punctulato, in medio vix depresso; antennis sat elongatis, articulis 1° ad oculi marginem posticum attingenti, 2° brevi, 3° quam 1^{us} fere duplo breviori, 4° quam 3^{us} sesquibreviori, 4°-7° inter se sat æqualibus, 8° quam 7^{us} paullo breviori fere transverso, 9° quam 6^{us}-8^{us} conjuncti vix breviori, 10° quam 9^{us} parum breviori, 11° quam 9^{us} parum longiori, articulis 9°-11° sat cylindricis; prothorace transverso, ut caput punctulato, a basi ad apicem angustato sed vix arcuatim, supra fere æquali sed trans basin summam depresso, hac fortiter bisinuata, angulis posticis acutis vix divergentibus; elytris subfortiter striatis, interstitiis minus crebre vix fortiter punctulatis; coxarum posticarum lamina ad basin fortiter angulatim dilatata, hinc ad marginem lateralem fortiter æqualiter gradatim angustata; tarsorum posticorum articulo basali quam 2^{us}-4^{us} conjuncti vix breviori; corpore subtus confertim punctulato.

Maris segmento ventrali apicali ad apicem leviter angulata.

Feminæ segmento ventrali apicali ad apicem late arcuato, nullo modo angulato.

Mountains of Tasmania.

Long. 3-4½ l. Lat. 1-1⅜ l.

D. victoriensis, sp. nov. Capite inter oculos fovea magna rotundata leviter sed manifeste impresso; antennarum articulis 9° obconico quam præcedentes 2 conjuncti subbreviori, 10° ovato quam 9^{us} vix breviori, 11° elongato-ovali ad apicem acuminato quam 9^{us} manifeste longiori; corpore subtus minus crebre punctulato; cetera ut *D. concolor.*

Long. 4¼ l. Lat. 1½ l.

The resemblance of this species to the preceding is so close that the description of it (with the exceptions noted above) may be taken as the description of *D. victoriensis.* On the under surface the prosternum of *D. concolor* is quite strongly and decidedly closely punctulate, the metasternum and hind-coxal laminæ less strongly but extremely closely, the ventral segments still more finely and closely. In *victoriensis* the middle part of the prosternum is sparingly and quite faintly punctured, the metasternum hind-coxal laminæ and ventral segments (especially the former) notably less closely and a trifle more strongly than in *concolor.* The difference of puncturation is most conspicuous on the middle part of the prosternum,—which moreover is rather strongly gibbous in *victoriensis* and very decidely less so in *concolor.*

Victoria (near the summit of Mount Baldy, 6000 feet above sea-level).

CURCULIONIDÆ.

NEOMERIMNETES (gen. nov. *Otiorhynchidarum*).

Rostrum quam caput angustius et paullo longius, subcylindricum, ad apicem subtruncatum, scrobibus lateralibus, rectis brevibus; antennæ sat elongatæ, sat graciles, scapo sat recto prothoracem vix attingenti, funiculi articulis 2° 3° que inter se æqualibus quam ceteri longioribus, clava sat elongata articulata; oculi subrotundati; prothorax quam latior vix longior, ad latera rotundatus, lobis ocularibus nullis; scutellum haud manifestum; elytra breviter ovalia, convexa, quam prothorax sat latiora; pedes modici, femoribus leviter clavatis, tibiis anticis sat rectis, tarsis sat brevibus (articulis 3° lato bilobo, 4° brevi), unguiculis connatis; segmentum ventrale 2^{um} ab 1° sutura sat recta divisum, quam 1^{us} sat brevius, quam 3^{us} parum longius; corpus squamosum.

This genus may be readily distinguished from its allies by the unusual proportions of its ventral segments, which in combination with its somewhat elongate rostrum and lateral scrobes made me hesitate as to whether it might not be related to *Centyres* rather than the *Otiorhynchides*. I have, however, consulted Mr. A. M. Lea (who has lately been doing much good work on the *Curculionidæ*) and he has satisfied me that its right place is near *Merimnetes*.

N. destructor, sp. nov. Piceus, antennis pedibusque rufescentibus; corpore supra squamis umbrinis parvis crebre sat æqualiter vestito; elytris punctulato-striatis, interstitiis planis sat latis.

Long. (rostr. excepto) $1\frac{1}{8}$ l. Lat. $\frac{3}{8}$ l (vix).

The structural characters are detailed in the diagnosis of the genus and need not be repeated here. The species is said to be destructive to strawberry plants.

S. Australia (near Adelaide).

LONGICORNES.

Thoris.

The following two new species may be referred to this genus which Mr. Pascoe distinguishes from *Coptocercus* by the shortness of the spines on its antennæ, its prothorax nodose on each side and its elytral puncturation not becoming suddenly obsolete beyond the middle. The above three characters are found in the insects before me. Mr. Pascoe however mentions two other characters (viz., the prothorax shorter than in *Coptocercus* and the apical joints of the antennæ unusually short in the female) the former of which is not particularly noticeable in either of these species while the latter is certainly wanting in the one of them of which the female is before me. Certainly, however, these discrepancies would not justify me in creating a new genus, especially in view of my strong opinion that the *Phoracanthid* genera are greatly in need of revision and that such revision can hardly be effected satisfactorily without a study of Mr. Pascoe's types (now in the British Museum). I should say, *e.g.*, that Mr. Pascoe has included in *Coptocercus* (under Newman's name *Callirhoe*) such diverse forms (as in the Catalogue in Linn. Soc.

Journ. ix.), that it is difficult to compare anything in precise terms with such an aggregate. The distinctive characters of a generic nature in the species before me are as follows: intermediate coxal cavities closed externally; head short; antennæ with two or three joints having apical spines, but these extremely small; femora pedunculated at their base; scutellum small; eyes very coarsely granulated; prothorax more or less tuberculate above and feebly and obtusely nodose on the sides; elytra not spined at apex, with smooth raised spots and strong puncturation becoming finer and feeble only gradually and very near to the apex. These characters are in the main the characters of *Thoris* and I should judge from the description of the unique species of that genus that the insects before me resemble it considerably in superficial respects. Judged by the descriptions the names *Thoris* and *Allotisis* may well be synonyms.

The distinction between the *Phoracanthides* and the *Callidiopsides* seems to be very fine. M. Lacordaire mentions a genus (*Acyrusa*) which he places in the latter aggregate in preference to the former merely on the ground that its colouring and sculpture are similar to those of a *Callidiopsid* genus. With this in mind it seems well to remark that both the following species (especially the former) decidedly have a *Callidiopsid* facies, but if it is allowable to refer to the *Callidiopsides* insects having several antennal joints spined I cannot see how the distinctness of the two groups can be maintained at all. I must acknowledge that in P.L.S. N.S.W., 1893, I very hesitatingly referred to the *Callidiopsides* a species (Porithea plagiata) which has more than 1 antennal joint spinose but I now incline to think I was wrong in doing so and that the species in question should be placed among the *Phoracanthides.*

T. septemguttata, sp. nov. Rufo-testacea, elytris guttis septenis parvis eburneis albidis ornatis; pilis elongatis erectis sparsim vestita; in prothorace maculis nonnullis minus insignibus aureo-pubescentibus instructa; capite brevi subtiliter ruguloso; prothorace obscure punctulato, quam latiori sat longiori, supra 5-tuberculato, subcylindrico sed ad latera leviter nodoso; elytris sat grosse (prope apicem gradatim obsolete) subseriatim punctulatis, ad apicem obtuse truncatis.

Maris antennis quam corpus sat longioribus, segmentis ventralibus pilis elongatis aureis dense vestitis.

Feminæ antennis quam corpus paullo longioribus; segmentis ventralibus nudis.

Long. 3-4 l. Lat. $\frac{3}{5}$-$\frac{4}{5}$ l.

The small white spots on each elytron are thus disposed: 1st behind the place of the humeral callus (which is obsolete), 2nd and 3rd placed transversely a little behind 1st, 4th about the middle of the elytron in a line longitudinally with 1st, 5th and 6th placed transversely a little behind 4th, 7th near the apex in a line longitudinally with 1st and 4th. The 3rd joint of the antennæ is much longer than the 4th; joints 3, 4 and 5, each have an extremely small spine at the apex,—that on joint 5 scarcely more than a minute denticulation.

N. S. Wales (Blue Mountains).

T. moerens, sp. nov. Mas. Supra picea, corpore subtus antennis palpis pedibusque castaneis, in elytris guttis parvis eburneis flavis 2 (his oblique paullo pone basin et prope marginem lateralem positis) et alia minus perspicua (hac paullo pone medium et prope suturam posita) ornata; capite brevi, inæquali, subtilius rugulose punctulato; antennis quam corpus sat longioribus, articulo 3° quam 4^{us} multo longiori, articulis 3°-5° ad apicem breviter spinosis, 6° ad apicem angulato sed haud perspicue spinoso; prothorace quam latiori fere dimidia parte longiori, sat longe pone apicem constricto, fere lævi, supra tuberculis circiter 9 instructo, ad latera obtuse nodoso; elytris sat grosse (prope apicem gradatim obsolete) subseriatim punctulatis, ad apicem recte truncatis (vel potius fere emarginatis).

Fem. latet.

Long. 5 l. Lat. $1\frac{1}{5}$ l.

The smooth ivory-like spots on the elytra are not very conspicuous, especially the hind one which is darker in colour than the others (in the type it is less conspicuous on one elytron than on the other). The antennal spines are very small but distinctly larger than those of the preceding species (*T. septemguttata*). I am unfortunately not able to describe the vestiture of the ventral segments as the abdomen of the type (which is otherwise a very fresh specimen) has been broken off.

S. Australia.

STENODERUS.

Mr. Gahan (Tr. E.S. Lond., 1894) furnishes some interesting remarks on this genus, referring especially to the peculiar sculpture of its head. In the course of those remarks he discusses *P. quietus*, Newm. (a Queensland species) and says that without having seen it he suggests the possibility of its being a var. of *S. suturalis*, Oliv. I have in my collection an example of the insect in question and can say decidedly that it is a good species, as the sculpture of its prothorax is quite different from that of *suturalis*. In the latter the hind part of the prothorax is much more abruptly than in *quietus* distinguished from the narrow front part and bears 5 distinct tubercles (a central large and feeble one, an anterior pair smaller but stronger, and a hind pair similar to the anterior pair but placed further apart), while in *quietus* the corresponding area can be called at most "feebly uneven," its unevenness being scarcely more than the result of a short longitudinal sulcus in front of the middle, on either side of which the surface is slightly gibbous. The following species is stated by Lacordaire to be identical with *Stenocorus lepturoides*, Boisd., and also with *Rhagiomorpha sordida*, Newm., and therefore (its name being older than either of them) to be the type of the genus *Rhagiomorpha*. Through the good offices of Mr. Masters I have before me a specimen found (by comparison with the type in the Macleay Museum) to be *Stenoderus concolor*. It does not belong even to the genus *Rhagiomorpha* but is congeneric with *Stenoderus suturalis*, Oliv., and is closely allied to *S. quietus*, Newm. As Mr. Macleay's description is unsatisfactorily brief, I venture to re-describe the insect as follows:

S. concolor, W. S. Macleay. Testacea, elytris stramineis, meso- et metasternis abdomineque infuscatis; antennis elongatis sat gracilibus; prothorace ante medium constricto, haud punctulato, supra late obtuse inæquali nec perspicue tuberculato; elytris lineis elevatis dorsalibus 4 bene definitis instructis.

Long. 6 l. Lat. $1\frac{1}{2}$ l.

Near *S. quietus*, Newm., but differing from it in colour [the under surface being quite destitute of iridescence and (in its darkest part) of a smoky brown colour, the antennæ scutellum

and legs being entirely testaceous or reddish testaceous], also in its very evidently less robust form and more slender antennæ. I have little doubt also but what the antennæ are more *elongate* than those of *quietus* but as they are both broken in my single example of that species I cannot be sure. I notice also that in my specimen of *quietus* the elevated line that forms the sutural margin of each elytron is much darker in colour than the other elevated lines, while in the numerous examples that I have seen of *S. concolor* in several collections that line is of the same pale straw colour as the other lines. Compared with *S. suturalis* the present species is seen to be very distinct by the very much less uneven surface of its prothorax on which there are no elevations that can be correctly called distinct tubercles; it also differs from *S. suturalis* in its much less robust antennæ, of which the basal point in particular is notably more slender. In a considerable number of specimens of *S. concolor* examined by me I have not found any variation in colouring, nor have I seen any variety of *S. suturalis* similarly coloured.

Victoria; Dividing Range; on flowers; Tasmania.

Syllitus.

S. heros, sp. nov. Nigro-fuscus, capite prothorace (hoc longitudinaliter plus minusve manifeste fusco-3-vittato) antennis versus apicem coxis genubus et (nonnullorum exemplorum) pedibus anticis et tarsis omnibus rufis, elytrorum sutura margine laterali et lineis 4 elevatis (e his 3^a brevi subhumerali) albidis; antennis maris quam corpus haud (feminæ paullo) brevioribus; capite subtilius minus confertim (postice sat confertim) punctulato; prothorace confertissime subtilissime subaspere puctulato, leviter obtuse 4 tuberculato, ante medium leviter constricto, pone medium lateraliter sat gibbo, trans basin sulcato; elytrorum lineis elevatis 1^a et 2^a (hac quam illa breviori) in medio fortiter divergentibus et inter se maculam pallidam intercludentibus.

Long. $5\frac{1}{2}$-6 l. Lat. 1 l.

Its large size distinguishes this species from all its described Australian congeners except *Parryi*; the numerous white lines on its elytra distinguishes it from them all. The suture and lateral margin are white and between these each elytron bears 4 raised white lines; the subsutural one nearly reaching the apex, the 2nd

a little less nearly, the 3rd not extending beyond the basal quarter of the length, the 4th becoming obsolete at about $\frac{3}{4}$ of the length of the elytra.

S.A. (On Eucalyptus flowers, near Quorn).

S. microps, sp. nov. Nigro-piceus, capite antennis (harum articulo basali plus minusve infuscato) prothorace pedibusque (horum femoribus plus minusve infuscatis) rufis; elytrorum margine laterali et lineis discoidalibus 2 elevatis (linea subsuturali quam altera sat breviori) albidis; antennis quam corpus brevioribus; capite sat elongato, antice sparsim postice crebre punctulato; oculis parvis; prothorace confertim subtiliter punctulato, minus perspicue obtuse 4-tuberculato leviter canaliculato, ante medium constricto, lateribus pone medium sat gibbis; elytrorum lineis albidis inter se sat parallelis.

Long. $2\frac{4}{5}$-$3\frac{1}{2}$ l. Lat. $\frac{2}{5}$-$\frac{1}{2}$ l.

The general resemblance of this species is to *S. rectus*, Newm; from which it may be readily distinguished *inter alia* by its more elongate head, smaller eyes, the subsutural white line on its elytra considerably shorter than the 2nd line, and the total absence of pale colouring on the elevated line that commences on the shoulder.

S. Australia, Victoria and Tasmania.

S. deustus, Newm. I do not know this species, which is described as of small size (Long. $\frac{3}{10}$ inch) and having both suture and lateral margin besides two discal lines and a short humeral one whitish, and the head and prothorax "fuscis, haud ferrugineis." Is it possibly a var. of *S. rectus?*

Homœmota.

H. lætabilis, sp. nov. Nitida; rufa, elytrorum parte dimidia apicali abdomineque nigris, elytris fascia angusta elevata eburnea mediana obliqua (hac suturam haud attingenti) ornatis; sparsim subtiliter setosa; prothorace quam latiori paullo longiori, ad basin abrupte tubulato, parte cetera globosa; utroque elytro ad basin valde obtuse tuberculato, vix manifeste punctulato.

Maris antennis quam corpus vix brevioribus; prothorace obsolete punctulato, minus nitido.

Feminæ antennis quam corpus sat brevioribus; prothorace subrugulose punctulato, magis nitido.

Long. $4\frac{4}{5}$ l. Lat. 1 l.

This species appears from the description of *H. Walkeri*, Gahan, to be allied to that insect although very different from it in respect of colour and markings, and also in other respects (*e.g.* the shorter antennæ of its male).

Victoria (Dividing Range); on flowers.

December 8.—1. "On some New Species of Victorian Mollusca," by G. B. Pritchard and J. H. Gatliff. 2. "Catalogue of the Marine Shells of Victoria, Part II.," by G. B. Pritchard and J. H. Gatliff. 3. "Contribution to the Petrology of Kerguelen Island," by Evelyn G. Hogg, M.A. 4. "The Oxidation of Cane Sugar by Aqueous Solutions of Potassium Permanganate," by W. Heber Green, B.Sc.

During the course of the year the Society has lost five members, one by resignation and four by death, while it has gained two members and five associates.

The Council has with especial regret to record the death of Sir Henry Barkly, who filled the presidential chair during the early days of the Society from 1860 to 1863, and of Mr. G. Foord and Mr. J. Bosisto, C.M.G., both of whom in past times have held official positions and been closely identified with the work of the Society.

During the year the following publications have been issued: "Proceedings," Vol. XI., Part I. (New Series) and Vol. XI., Part II. In accordance with the decision of the Council, the "Proceedings" have been issued in two parts, so as to facilitate, as far as possible, the early publication of papers presented to the Society.

The Council has still to regret that owing to lack of funds it is not possible to publish all the material which is available, but with the return of more prosperous times it hopes that the number of members and the annual grant received from the Government, which is now only £100, may be increased.

The Librarian reports as follows:—The addition to the Library during the year number 1023 volumes and parts of volumes. A card Catalogue of the Library has been completed and placed in drawers. The sum of twenty pounds has been spent in binding, and a cheaper style has been adopted. In order to preserve the unbound volumes they have been tied up in strong brown paper, the number of parcels amounting to 1375. There are now more than 5000 volumes in the Society's Library, of which over 2000 are bound.

The Honorary Treasurer in Account with the Royal Society of Victoria.

Dr.

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1899.

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La Museo de la Plata ... ... Buenos Ayres

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K. K. Geographische Gesellschaft ... ... Vienna
K. K. Geologische Reichsanstalt ... ... Vienna
K. K. Naturhistorisches Hofmuseum ... ... Vienna
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Geological and Natural History Survey of Canada ... Ottawa
Minister's Office (Militia and Defence) ... ... Ottawa
Natural History Society of Montreal ... ... Montreal
Nova Scotian Institute of Science ... ... Halifax
Royal Society of Canada ... ... Montreal

CAPE COLONY.

South African Museum ... ... Cape Town
South African Philosophical Society, Observatory ... Cape Town

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Kon. Danske Videnskaberne Selskab. ... ...Copenhagen

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British Museum	London
British Museum (Natural History)	London
Colonial Office Library	London
Foreign Office Library	London
Free Public Library	Liverpool
Geological Society	London
Geologists' Association	London
Institute of Mining and Mechanical Engineers	Newcastle
Linnæan Society	London
Literary and Philosophical Society	Manchester
Liverpool Biological Society	Liverpool
Liverpool Literary and Philosophical Society	Liverpool
Manchester Museum, Owens College	Manchester
Marine Biological Laboratory	Plymouth
"Nature"	London
Owens College Library	Manchester
Patent Office, 25 Southampton Buildings	London
Philosophical Society	Cambridge
Physical Society	London
Radcliffe Library	Oxford
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Royal Colonial Institute	London
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Royal Society	London
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University College	London
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Faculté des Sciences	Marseilles
Feuilles des Jeunes Naturalistes	Paris
Observatoire Météorologique du Mont Blanc	Paris
Société des Sciences Naturelles de l'Ouest de la France (Museum)	Nantes
Société Nationale de Cherbourg	Cherbourg
Société Zoologique de France	Paris

Germany.

Deutsche Geologische Gesellshaft	Berlin
Gesellschaft für Erdkunde	Berlin
Jenaische Zeitsch. f. Medicin und Naturwissenschaft	Jena
Königl.-bäyer. Akademie der Wissenschaften ...	Munich
Königl. Museum für Naturkunde, Zoologische Sammlung	Berlin
Königl. Offentl. Bibliothek	Dresden
Königl. Preussische Akademie der Wissenschaften ...	Berlin
Königl. Sächs. Gesellschaft der Wissenschaften ...	Leipzig
Königl. Gesellschaft der Wissenschaften	Göttingen
Naturforschende Gesellschaft	Emden
Naturforschende Gesellschaft	Leipzig
Naturforschende Gesellschaft Bleichstrasse 59.	Frankfurt am M.
Naturhistorisch-Medicinischer Verein	Heidelberg
Naturhistorische Gesellschaft	Nürnberg
Naturhistorisches Museum	Hamburg
Naturwissenschaftlicher Verein	Bremen
Oberhessische Gesellschaft für Natur u. Heilkunde ...	Giessen
Schlesische Gesellschaft für vaterländische Cultur ...	Breslau
Verein für Erdkunde	Darmstadt
Verein für Erdkunde	Halle
Verein für Naturkunde	Kassel

Holland.

Musée Teyler	Haarlem
Natuurkundig Genootschap	Groningen
Nederlandsche Botanische Vereeniging	Nijmegen
Kon. Akademie van Wetenschappen	Amsterdam
Rijks Geologische Mineralogische Museum ...	Leyden
Société Hollandaise des Sciences	Haarlem
Société Provinciale des Arts et Sciences	Utrecht

India.

Asiatic Society of Bengal	Calcutta
Geological Survey of India	Calcutta
Indian Museum	Calcutta
Madras Literary Society	Madras
Royal Asiatic Society, Ceylon Branch	Colombo

Ireland.

Belfast Natural History and Philosophical Society ...	Belfast
Royal Dublin Society	Dublin
Royal Irish Academy	Dublin
Trinity College Library	Dublin

ITALY.

Biblioteca Nazionale Centrale Vittorio Emanuele ...	Rome
Museo di Zoologia ed Anatomia Comp., R. Università	Turin
Ministerio dei Lavori Pubblici	Rome
Reale Accademia dei Lincei	Rome
R. Accademia delle Scienze dell' Istituto	Bologna
Reale Accademia di Scienze	Palermo
Reale Accademia di Scienze, Lettere ed Arti ...	Lucca
Regia Accademia di Scienze, Lettere ed Arti ...	Modena
Società Geografica Italiana	Rome
Società Toscana di Scienze Naturali	Pisa
Zoological Station	Naples

JAPAN.

Imperial University	Tokio

JAVA.

Bataviaasch Genootschap van Kunsten en Wetenschappen	Batavia
Magnetical and Meteorological Observatory ...	Batavia

MAURITIUS.

Royal Alfred Observatory	Mauritius

MEXICO.

Ministerio de Fomento	Mexico
Observatorio Meteorologico Magnetico Central ...	Mexico
Observatorio Astronomico Nacional	Tacubaya
Sociedad Científica, "Antonio Alzate"	Mexico

NEW SOUTH WALES.

Australian Museum	Sydney
Astronomical Observatory	Sydney
Botanic Gardens	Sydney
Department of Agriculture	Sydney
Department of Mines	Sydney
Linnæan Society of New South Wales	Sydney
Parliamentary Library	Sydney
Public Library	Sydney
Royal Society	Sydney
Technological Museum..	Sydney
University Library	Sydney

New Zealand.

Auckland Institute and Museum ... ... Auckland
Colonial Museum and Geological Survey Department Wellington
Museum ... ... Christchurch
New Zealand Institute ... ... Wellington
Otago Institute ... ... Dunedin
Parliamentary Library ... ... Wellington
Public Library ... ... Wellington

Norway.

Bergens Museum ... ... Bergen
Videnskabs-Selskabet ... ... Christiania

Portugal.

Sociedade de Geographia ... ... Lisbon

Queensland.

Parliamentary Library ... ... Brisbane
Public Library and Museum ... ... Brisbane
Royal Geographical Society ... ... Brisbane
Royal Society of Queensland ... ... Brisbane

Roumania.

Institut Météorologique de Roumanie ... ... Bucharest

Russia.

Académie Impériale des Sciences ... St. Petersburg
Jardin Botanique Imperial ... ... St. Petersburg
Minister of Agriculture, St. Petersburg, c/o Russian Consulate ... ... Melbourne
Societas Scientiarum Fennica ... ... Helsingfors, Finland
Société des Naturalistes de l'Université de Kasan ... Kasan
Société des Naturalistes ... ... Kiew
Société des Naturalistes de la Nouvelle Russie ... Odessa
Société Impériale des Naturalistes ... ... Moscow
Société Impériale Russe de Geographie ... St. Petersburg

Scotland.

Botanical Society	Edinburgh
Geological Society	Edinburgh
Royal College of Physicians' Laboratory	Edinburgh
Royal Physical Society	Edinburgh
Royal Scottish Geographical Society	Edinburgh
Royal Scottish Society of Arts	Edinburgh
Royal Society	Edinburgh
University Library	Edinburgh
University Library	Glasgow
Philosophical Society	Glasgow

South Australia.

Parliamentary Library	Adelaide
Public Library and Museum	Adelaide
Royal Society of South Australia	Adelaide
University Library	Adelaide

Spain.

Real Academía de Ciencias exactas, físicas y naturaes	Madrid

Sweden.

Entomologiska Föreningen	Stockholm
Kongl. Universitets Bibliotek	Upsala
Kongl. Vetenskaps Akademi	Stockholm
Kongl. Vitterhets Historie och Antiquets Akademi	Stockholm
Kungl. Vetenskaps och Vitterhets Samhälle ...	Göteborg
Sverige Geologiska Undersokning	Stockholm

Switzerland.

Geographische Gesellschaft	Berne
Naturforschende Gesellschaft	Zürich
Schweizerische Naturforschende Gesellschaft ...	Berne
Société de Physique et d'Histoire Naturelle ...	Genève

Tasmania.

Parliamentary Library	Hobart
Public Library	Hobart
Royal Society of Tasmania	Hobart

United States of America.

Academy of Natural Sciences	Philadelphia
American Microscopical Journal	... New York
American Museum of Natural History, Central Park	New York
American Academy of Arts and Sciences	Boston
American Geographical Society	... New York
American Philosophical Society	Philadelphia
Augustana Library	Augustana, Illinois
Bureau of Ethnology, Smithsonian Institute	Washington, D.C.
California Academy of Sciences	San Francisco, Cal.
Cooper Union for the Advancement of Science & Art	New York
Davenport Academy of Natural Sciences	Davenport
Denison University	Dension, Ohio
Department of Agriculture	Washington, D.C.
Field Columbian Museum	Chicago
Geological Survey	Iowa
Iowa Academy of Sciences	Iowa
Johns Hopkins University	Baltimore
Missouri Botanical Garden	St. Louis
New York Public Library	New York
Philadelphia Commercial Museum ...	Philadelphia
Philosophical Society	Washington, D.C.
St. Louis Academy of Science	St. Louis
"Science"	New York
Smithsonian Institution	Washington, D.C.
Society of Natural History	Boston
Society of Natural Sciences	Buffalo
State Laboratory of Natural History ...	Urbana, Illinois
Texas Academy of Sciences	Austin, Tex.
United States Geological Survey ...	Washington, D.C.
University of California	Berkeley, Cal.
University of Kansas	Lawrence, Kan.
Wagner Free Institute of Science ...	Philadelphia
Wisconsin Academy of Sciences, Arts, & Letters	Madison, Wis.

Uruguay.

Museo Nacional	Montevideo

Victoria.

"Age"	Melbourne
"Argus"	Melbourne
Athenæum	Melbourne
Astronomical Observatory	Melbourne
Australasian Institute of Mining Engineers ...	Melbourne

Chief Secretary's Office	Melbourne
Department of Mines and Water Supply	Melbourne
Field Naturalists' Club of Victoria	Melbourne
Free Library	Echuca
Free Library	Geelong
Free Library	Bendigo
Geological Society of Australasia	Melbourne
Gordon Technical College	Geelong
Government Entomologist	Melbourne
Government Statist	Melbourne
Intercolonial Medical Journal of Australasia ...	Melbourne
Medical Society of Victoria	Melbourne
Parliamentary Library	Melbourne
Pharmaceutical Society of Australasia	Melbourne
Public Library	Melbourne
Railway Library	Melbourne
Royal Geographical Society	Melbourne
Royal Mint	Melbourne
School of Mines	Ballarat
School of Mines	Castlemaine
School of Mines	Bendigo
School of Mines	Maryborough
School of Mines	Bairnsdale
School of Mines	Stawell
Prahran Public Library	Prahran
University Library	Melbourne
Victorian Chamber of Manufactures ...	Melbourne
Victorian Institute of Engineers	Melbourne
Victorian Institute of Surveyors	Melbourne
Working Men's College	Melbourne

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Observatory...	Perth
Geological Survey Office	Perth

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(The names of new genera and species are Printed in Italics).

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